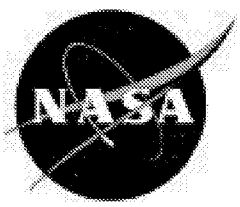
NASA/SP—1999–7037/SUPPL391
January 8, 1999

# AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES



National Aeronautics and
Space Administration
**Langley Research Center**
**Scientific and Technical
Information Program Office**

# The NASA STI Program Office . . . in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA Scientific and Technical Information (STI) Program Office plays a key part in helping NASA maintain this important role.

The NASA STI Program Office is operated by Langley Research Center, the lead center for NASA's scientific and technical information. The NASA STI Program Office provides access to the NASA STI Database, the largest collection of aeronautical and space science STI in the world. The Program Office is also NASA's institutional mechanism for disseminating the results of its research and development activities. These results are published by NASA in the NASA STI Report Series, which includes the following report types:

- TECHNICAL PUBLICATION. Reports of completed research or a major significant phase of research that present the results of NASA programs and include extensive data or theoretical analysis. Includes compilations of significant scientific and technical data and information deemed to be of continuing reference value. NASA's counterpart of peer-reviewed formal professional papers but has less stringent limitations on manuscript length and extent of graphic presentations.

- TECHNICAL MEMORANDUM. Scientific and technical findings that are preliminary or of specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.

- CONTRACTOR REPORT. Scientific and technical findings by NASA-sponsored contractors and grantees.

- CONFERENCE PUBLICATION. Collected papers from scientific and technical conferences, symposia, seminars, or other meetings sponsored or cosponsored by NASA.

- SPECIAL PUBLICATION. Scientific, technical, or historical information from NASA programs, projects, and missions, often concerned with subjects having substantial public interest.

- TECHNICAL TRANSLATION. English-language translations of foreign scientific and technical material pertinent to NASA's mission.

Specialized services that complement the STI Program Office's diverse offerings include creating custom thesauri, building customized databases, organizing and publishing research results . . . even providing videos.

For more information about the NASA STI Program Office, see the following:

- Access the NASA STI Program Home Page at ***http://www.sti.nasa.gov***

- E-mail your question via the Internet to help@sti.nasa.gov

- Fax your question to the NASA STI Help Desk at (301) 621-0134

- Telephone the NASA STI Help Desk at (301) 621-0390

- Write to:
  NASA STI Help Desk
  NASA Center for AeroSpace Information
  7121 Standard Drive
  Hanover, MD 21076-1320

# Introduction

This supplemental issue of *Aeronautical Engineering, A Continuing Bibliography with Indexes* (NASA/SP—1999-7037) lists reports, articles, and other documents recently announced in the NASA STI Database.

The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles.

Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract.

The NASA CASI price code table, addresses of organizations, and document availability information are included before the abstract section.

Two indexes—subject and author are included after the abstract section.

# *SCAN Goes Electronic!*

If you have electronic mail or if you can access the Internet, you can view biweekly issues of *SCAN* from your desktop absolutely free!

*Electronic SCAN* takes advantage of computer technology to inform you of the latest worldwide, aerospace-related, scientific and technical information that has been published.

No more waiting while the paper copy is printed and mailed to you. You can view *Electronic SCAN* the same day it is released—up to 191 topics to browse at your leisure. When you locate a publication of interest, you can print the announcement. You can also go back to the *Electronic SCAN* home page and follow the ordering instructions to quickly receive the full document.

Start your access to *Electronic SCAN* today. Over 1,000 announcements of new reports, books, conference proceedings, journal articles...and more—available to your computer every two weeks.


For Internet access to *E-SCAN*, use any of the following addresses:

http://www.sti.nasa.gov
**ftp.sti.nasa.gov**
**gopher.sti.nasa.gov**

To receive a free subscription, send e-mail for complete information about the service first. Enter **scan@sti.nasa.gov** on the address line. Leave the subject and message areas blank and send. You will receive a reply in minutes.

Then simply determine the SCAN topics you wish to receive and send a second e-mail to **listserve@sti.nasa.gov**. Leave the subject line blank and enter a subscribe command in the message area formatted as follows:

**Subscribe <desired list> <Your name>**

For additional information, e-mail a message to **help@sti.nasa.gov**.

Phone: (301) 621-0390

Fax: (301) 621-0134

Write: NASA STI Help Desk
NASA Center for AeroSpace Information
7121 Standard Drive
Hanover, MD 21076-1320

**Looking just for *Aerospace Medicine and Biology* reports?**

Although hard copy distribution has been discontinued, you can still receive these vital announcements through your *E-SCAN* subscription. Just **subscribe SCAN-AEROMED** in the message area of your e-mail to **listserve@sti.nasa.gov**.

# Table of Contents

Records are arranged in categories 1 through 19, the first nine coming from the Aeronautics division of *STAR*, followed by the remaining division titles. Selecting a category will link you to the collection of records cited in this issue pertaining to that category.

# Indexes

Two indexes are available. You may use the find command under the tools menu while viewing the PDF file for direct match searching on any text string. You may also view the indexes provided, for searching on *NASA Thesaurus* subject terms and author names.



Selecting an index above will link you to that comprehensive listing.

# Document Availability

Select **Availability Info** for important information about NASA Scientific and Technical Information (STI) Program Office products and services, including registration with the NASA Center for AeroSpace Information (CASI) for access to the NASA CASI TRS (Technical Report Server), and availability and pricing information for cited documents.

# *The New NASA Video Catalog is Here*

Free!

To order your copy,
call the NASA STI Help Desk at
(301) 621-0390,
fax to
(301) 621-0134,
e-mail to
help@sti.nasa.gov,
or visit the NASA STI Program
homepage at
http://www.sti.nasa.gov

*(Select STI Program Bibliographic Announcements)*

# *Explore the Universe!*

# Document Availability Information

The mission of the NASA Scientific and Technical (STI) Program Office is to quickly, efficiently, and cost-effectively provide the NASA community with desktop access to STI produced by NASA and the world's aerospace industry and academia. In addition, we will provide the aerospace industry, academia, and the taxpayer access to the intellectual scientific and technical output and achievements of NASA.

## Eligibility and Registration for NASA STI Products and Services

The NASA STI Program offers a wide variety of products and services to achieve its mission. Your affiliation with NASA determines the level and type of services provided by the NASA STI Program. To assure that appropriate level of services are provided, NASA STI users are requested to register at the NASA Center for AeroSpace Information (CASI). Please contact NASA CASI in one of the following ways:

| | |
|---|---|
| E-mail: | help@sti.nasa.gov |
| Fax: | 301-621-0134 |
| Phone: | 301-621-0390 |
| Mail: | ATTN: Registration Services<br>NASA Center for AeroSpace Information<br>7121 Standard Drive<br>Hanover, MD 21076-1320 |

## Limited Reproducibility

In the database citations, a note of limited reproducibility appears if there are factors affecting the reproducibility of more than 20 percent of the document. These factors include faint or broken type, color photographs, black and white photographs, foldouts, dot matrix print, or some other factor that limits the reproducibility of the document. This notation also appears on the microfiche header.

## NASA Patents and Patent Applications

Patents and patent applications owned by NASA are announced in the STI Database. Printed copies of patents (which are not microfiched) are available for purchase from the U.S. Patent and Trademark Office.

When ordering patents, the U.S. Patent Number should be used, and payment must be remitted in advance, by money order or check payable to the Commissioner of Patents and Trademarks. Prepaid purchase coupons for ordering are also available from the U.S. Patent and Trademark Office.

NASA patent application specifications are sold in both paper copy and microfiche by the NASA Center for AeroSpace Information (CASI). The document ID number should be used in ordering either paper copy or microfiche from CASI.

The patents and patent applications announced in the STI Database are owned by NASA and are available for royalty-free licensing. Requests for licensing terms and further information should be addressed to:

National Aeronautics and Space Administration
Associate General Counsel for Intellectual Property
Code GP
Washington, DC 20546-0001

## Sources for Documents

One or more sources from which a document announced in the STI Database is available to the public is ordinarily given on the last line of the citation. The most commonly indicated sources and their acronyms or abbreviations are listed below, with an Addresses of Organizations list near the back of this section. If the publication is available from a source other than those listed, the publisher and his address will be displayed on the availability line or in combination with the corporate source.

Avail: NASA CASI. Sold by the NASA Center for AeroSpace Information. Prices for hard copy (HC) and microfiche (MF) are indicated by a price code following the letters HC or MF in the citation. Current values are given in the NASA CASI Price Code Table near the end of this section.

*Note on Ordering Documents: When ordering publications from NASA CASI, use the document ID number or other report number. It is also advisable to cite the title and other bibliographic identification.*

Avail: SOD (or GPO). Sold by the Superintendent of Documents, U.S. Government Printing Office, in hard copy.

Avail: BLL (formerly NLL): British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England. Photocopies available from this organization at the price shown. (If none is given, inquiry should be addressed to the BLL.)

Avail: DOE Depository Libraries. Organizations in U.S. cities and abroad that maintain collections of Department of Energy reports, usually in microfiche form, are listed in Energy Research Abstracts. Services available from the DOE and its depositories are described in a booklet, *DOE Technical Information Center—Its Functions and Services* (TID-4660), which may be obtained without charge from the DOE Technical Information Center.

Avail: ESDU. Pricing information on specific data, computer programs, and details on ESDU International topic categories can be obtained from ESDU International.

Avail: Fachinformationszentrum Karlsruhe. Gesellschaft für wissenschaftlich-technische Information mbH 76344 Eggenstein-Leopoldshafen, Germany.

Avail: HMSO. Publications of Her Majesty's Stationery Office are sold in the U.S. by Pendragon House, Inc. (PHI), Redwood City, CA. The U.S. price (including a service and mailing charge) is given, or a conversion table may be obtained from PHI.

Avail: Issuing Activity, or Corporate Author, or no indication of availability. Inquiries as to the availability of these documents should be addressed to the organization shown in the citation as the corporate author of the document.

Avail: NASA Public Document Rooms. Documents so indicated may be examined at or purchased from the National Aeronautics and Space Administration (JBD-4), Public Documents Room (Room 1H23), Washington, DC 20546-0001, or public document rooms located at NASA installations, and the NASA Pasadena Office at the Jet Propulsion Laboratory.

Avail: NTIS. Sold by the National Technical Information Service. Initially distributed microfiche under the NTIS SRIM (Selected Research in Microfiche) are available. For information concerning this service, consult the NTIS Subscription Section, Springfield, VA 22161.

Avail: Univ. Microfilms. Documents so indicated are dissertations selected from Dissertation Abstracts and are sold by University Microfilms as xerographic copy (HC) and microfilm. All requests should cite the author and the Order Number as they appear in the citation.

Avail: US Patent and Trademark Office. Sold by Commissioner of Patents and Trademarks, U.S. Patent and Trademark Office, at the standard price of $1.50 each, postage free.

Avail: (US Sales Only). These foreign documents are available to users within the United States from the National Technical Information Service (NTIS). They are available to users outside the United States through the International Nuclear Information Service (INIS) representative in their country, or by applying directly to the issuing organization.

Avail: USGS. Originals of many reports from the U.S. Geological Survey, which may contain color illustrations, or otherwise may not have the quality of illustrations preserved in the microfiche or facsimile reproduction, may be examined by the public at the libraries of the USGS field offices whose addresses are listed on the Addresses of Organizations page. The libraries may be queried concerning the availability of specific documents and the possible utilization of local copying services, such as color reproduction.

# Addresses of Organizations

British Library Lending Division
Boston Spa, Wetherby, Yorkshire
England

Commissioner of Patents and Trademarks
U.S. Patent and Trademark Office
Washington, DC 20231

Department of Energy
Technical Information Center
P.O. Box 62
Oak Ridge, TN 37830

European Space Agency–
Information Retrieval Service ESRIN
Via Galileo Galilei
00044 Frascati (Rome) Italy

ESDU International
27 Corsham Street
London
N1 6UA
England

Fachinformationszentrum Karlsruhe
Gesellschaft für wissenschaftlich–technische
Information mbH
76344 Eggenstein–Leopoldshafen, Germany

Her Majesty's Stationery Office
P.O. Box 569, S.E. 1
London, England

NASA Center for AeroSpace Information
7121 Standard Drive
Hanover, MD 21076-1320

(NASA STI Lead Center)
National Aeronautics and Space Administration
Scientific and Technical Information Program Office
Langley Research Center – MS157
Hampton, VA 23681

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

Pendragon House, Inc.
899 Broadway Avenue
Redwood City, CA 94063

Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

University Microfilms
A Xerox Company
300 North Zeeb Road
Ann Arbor, MI 48106

University Microfilms, Ltd.
Tylers Green
London, England

U.S. Geological Survey Library National Center
MS 950
12201 Sunrise Valley Drive
Reston, VA 22092

U.S. Geological Survey Library
2255 North Gemini Drive
Flagstaff, AZ 86001

U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025

U.S. Geological Survey Library
Box 25046
Denver Federal Center, MS914
Denver, CO 80225

# NASA CASI Price Code Table

(Effective July 1, 1998)

| Code | U.S., Canada, & Mexico | Foreign |
|---|---|---|
| A01 | $ 8.00 | $ 16.00 |
| A02 | 12.00 | 24.00 |
| A03 | 23.00 | 46.00 |
| A04 | 25.50 | 51.00 |
| A05 | 27.00 | 54.00 |
| A06 | 29.50 | 59.00 |
| A07 | 33.00 | 66.00 |
| A08 | 36.00 | 72.00 |
| A09 | 41.00 | 82.00 |
| A10 | 44.00 | 88.00 |
| A11 | 47.00 | 94.00 |
| A12 | 51.00 | 102.00 |
| A13 | 54.00 | 108.00 |
| A14 | 56.00 | 112.00 |
| A15 | 58.00 | 116.00 |
| A16 | 60.00 | 120.00 |
| A17 | 62.00 | 124.00 |
| A18 | 65.50 | 131.00 |
| A19 | 67.50 | 135.00 |
| A20 | 69.50 | 139.00 |
| A21 | 71.50 | 143.00 |
| A22 | 77.00 | 154.00 |
| A23 | 79.00 | 158.00 |
| A24 | 81.00 | 162.00 |
| A25 | 83.00 | 166.00 |
| A99 | Contact NASA CASI | |

| Code | U.S., Canada, & Mexico | Foreign |
|---|---|---|
| E01 | $101.00 | $202.00 |
| E02 | 109.50 | 219.00 |
| E03 | 119.50 | 238.00 |
| E04 | 128.50 | 257.00 |
| E05 | 138.00 | 276.00 |
| E06 | 146.50 | 293.00 |
| E07 | 156.00 | 312.00 |
| E08 | 165.50 | 331.00 |
| E09 | 174.00 | 348.00 |
| E10 | 183.50 | 367.00 |
| E11 | 193.00 | 386.00 |
| E12 | 201.00 | 402.00 |
| E13 | 210.50 | 421.00 |
| E14 | 220.00 | 440.00 |
| E15 | 229.50 | 459.00 |
| E16 | 238.00 | 476.00 |
| E17 | 247.50 | 495.00 |
| E18 | 257.00 | 514.00 |
| E19 | 265.50 | 531.00 |
| E20 | 275.00 | 550.00 |
| E21 | 284.50 | 569.00 |
| E22 | 293.00 | 586.00 |
| E23 | 302.50 | 605.00 |
| E24 | 312.00 | 624.00 |
| E99 | Contact NASA CASI | |

## Payment Options

All orders must be prepaid unless you are registered for invoicing or have a deposit account with the NASA CASI. Payment can be made by VISA, MasterCard, American Express, or Diner's Club credit card. Checks or money orders must be in U.S. currency and made payable to "NASA Center for AeroSpace Information." To register, please request a registration form through the NASA STI Help Desk at the numbers or addresses below.

Handling fee per item is $1.50 domestic delivery to any location in the United States and $9.00 foreign delivery to Canada, Mexico, and other foreign locations. Video orders incur an additional $2.00 handling fee per title.

The fee for shipping the safest and fastest way via Federal Express is in addition to the regular handling fee explained above—$5.00 domestic per item, $27.00 foreign for the first 1-3 items, $9.00 for each additional item.

## Return Policy

The NASA Center for AeroSpace Information will replace or make full refund on items you have requested if we have made an error in your order, if the item is defective, or if it was received in damaged condition, and you contact CASI within 30 days of your original request.

NASA Center for AeroSpace Information
7121 Standard Drive
Hanover, MD 21076-1320

E-mail: help@sti.nasa.gov
Fax: (301) 621-0134
Phone: (301) 621-0390

Rev. 7/98

## Federal Depository Library Program

In order to provide the general public with greater access to U.S. Government publications, Congress established the Federal Depository Library Program under the Government Printing Office (GPO), with 53 regional depositories responsible for permanent retention of material, inter-library loan, and reference services. At least one copy of nearly every NASA and NASA-sponsored publication, either in printed or microfiche format, is received and retained by the 53 regional depositories. A list of the Federal Regional Depository Libraries, arranged alphabetically by state, appears at the very end of this section. These libraries are not sales outlets. A local library can contact a regional depository to help locate specific reports, or direct contact may be made by an individual.

## Public Collection of NASA Documents

An extensive collection of NASA and NASA-sponsored publications is maintained by the British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England for public access. The British Library Lending Division also has available many of the non-NASA publications cited in the STI Database. European requesters may purchase facsimile copy or microfiche of NASA and NASA-sponsored documents FIZ–Fachinformation Karlsruhe–Bibliographic Service, D-76344 Eggenstein-Leopoldshafen, Germany and TIB–Technische Informationsbibliothek, P.O. Box 60 80, D-30080 Hannover, Germany.

## Submitting Documents

All users of this abstract service are urged to forward reports to be considered for announcement in the STI Database. This will aid NASA in its efforts to provide the fullest possible coverage of all scientific and technical publications that might support aeronautics and space research and development. If you have prepared relevant reports (other than those you will transmit to NASA, DOD, or DOE through the usual contract- or grant-reporting channels), please send them for consideration to:

ATTN: Acquisitions Specialist
NASA Center for AeroSpace Information
7121 Standard Drive
Hanover, MD 21076-1320.

Reprints of journal articles, book chapters, and conference papers are also welcome.

You may specify a particular source to be included in a report announcement if you wish; otherwise the report will be placed on a public sale at the NASA Center for AeroSpace Information. Copyrighted publications will be announced but not distributed or sold.

# Federal Regional Depository Libraries

## ALABAMA

**AUBURN UNIV. AT MONTGOMERY LIBRARY**
Documents Dept.
7300 University Dr.
Montgomery, AL 36117–3596
(205) 244–3650 Fax: (205) 244–0678

**UNIV. OF ALABAMA**
Amelia Gayle Gorgas Library
Govt. Documents
P.O. Box 870266
Tuscaloosa, AL 35487–0266
(205) 348–6046 Fax: (205) 348–0760

## ARIZONA

**DEPT. OF LIBRARY, ARCHIVES, AND PUBLIC RECORDS**
Research Division
Third Floor, State Capitol
1700 West Washington
Phoenix, AZ 85007
(602) 542–3701 Fax: (602) 542–4400

## ARKANSAS

**ARKANSAS STATE LIBRARY**
State Library Service Section
Documents Service Section
One Capitol Mall
Little Rock, AR 72201–1014
(501) 682–2053 Fax: (501) 682–1529

## CALIFORNIA

**CALIFORNIA STATE LIBRARY**
Govt. Publications Section
P.O. Box 942837 – 914 Capitol Mall
Sacramento, CA 94337–0091
(916) 654–0069 Fax: (916) 654–0241

## COLORADO

**UNIV. OF COLORADO – BOULDER**
Libraries – Govt. Publications
Campus Box 184
Boulder, CO 80309–0184
(303) 492–8834 Fax: (303) 492–1881

**DENVER PUBLIC LIBRARY**
Govt. Publications Dept. BSG
1357 Broadway
Denver, CO 80203–2165
(303) 640–8846 Fax: (303) 640–8817

## CONNECTICUT

**CONNECTICUT STATE LIBRARY**
231 Capitol Avenue
Hartford, CT 06106
(203) 566–4971 Fax: (203) 566–3322

## FLORIDA

**UNIV. OF FLORIDA LIBRARIES**
Documents Dept.
240 Library West
Gainesville, FL 32611–2048
(904) 392–0366 Fax: (904) 392–7251

## GEORGIA

**UNIV. OF GEORGIA LIBRARIES**
Govt. Documents Dept.
Jackson Street
Athens, GA 30602–1645
(706) 542–8949 Fax: (706) 542–4144

## HAWAII

**UNIV. OF HAWAII**
Hamilton Library
Govt. Documents Collection
2550 The Mall
Honolulu, HI 96822
(808) 948–8230 Fax: (808) 956–5968

## IDAHO

**UNIV. OF IDAHO LIBRARY**
Documents Section
Rayburn Street
Moscow, ID 83844–2353
(208) 885–6344 Fax: (208) 885–6817

## ILLINOIS

**ILLINOIS STATE LIBRARY**
Federal Documents Dept.
300 South Second Street
Springfield, IL 62701–1796
(217) 782–7596 Fax: (217) 782–6437

## INDIANA

**INDIANA STATE LIBRARY**
Serials/Documents Section
140 North Senate Avenue
Indianapolis, IN 46204–2296
(317) 232–3679 Fax: (317) 232–3728

## IOWA

**UNIV. OF IOWA LIBRARIES**
Govt. Publications
Washington & Madison Streets
Iowa City, IA 52242–1166
(319) 335–5926 Fax: (319) 335–5900

## KANSAS

**UNIV. OF KANSAS**
Govt. Documents & Maps Library
6001 Malott Hall
Lawrence, KS 66045–2800
(913) 864–4660 Fax: (913) 864–3855

## KENTUCKY

**UNIV. OF KENTUCKY**
King Library South
Govt. Publications/Maps Dept.
Patterson Drive
Lexington, KY 40506–0039
(606) 257–3139 Fax: (606) 257–3139

## LOUISIANA

**LOUISIANA STATE UNIV.**
Middleton Library
Govt. Documents Dept.
Baton Rouge, LA 70803–3312
(504) 388–2570 Fax: (504) 388–6992

**LOUISIANA TECHNICAL UNIV.**
Prescott Memorial Library
Govt. Documents Dept.
Ruston, LA 71272–0046
(318) 257–4962 Fax: (318) 257–2447

## MAINE

**UNIV. OF MAINE**
Raymond H. Fogler Library
Govt. Documents Dept.
Orono, ME 04469–5729
(207) 581–1673 Fax: (207) 581–1653

## MARYLAND

**UNIV. OF MARYLAND – COLLEGE PARK**
McKeldin Library
Govt. Documents/Maps Unit
College Park, MD 20742
(301) 405–9165 Fax: (301) 314–9416

## MASSACHUSETTS

**BOSTON PUBLIC LIBRARY**
Govt. Documents
666 Boylston Street
Boston, MA 02117–0286
(617) 536–5400, ext. 226
Fax: (617) 536–7758

## MICHIGAN

**DETROIT PUBLIC LIBRARY**
5201 Woodward Avenue
Detroit, MI 48202–4093
(313) 833–1025 Fax: (313) 833–0156

**LIBRARY OF MICHIGAN**
Govt. Documents Unit
P.O. Box 30007
717 West Allegan Street
Lansing, MI 48909
(517) 373–1300 Fax: (517) 373–3381

## MINNESOTA

**UNIV. OF MINNESOTA**
Govt. Publications
409 Wilson Library
309 19th Avenue South
Minneapolis, MN 55455
(612) 624–5073 Fax: (612) 626–9353

## MISSISSIPPI

**UNIV. OF MISSISSIPPI**
J.D. Williams Library
106 Old Gym Bldg.
University, MS 38677
(601) 232–5857 Fax: (601) 232–7465

## MISSOURI

**UNIV. OF MISSOURI – COLUMBIA**
106B Ellis Library
Govt. Documents Sect.
Columbia, MO 65201–5149
(314) 882–6733 Fax: (314) 882–8044

## MONTANA

**UNIV. OF MONTANA**
Mansfield Library
Documents Division
Missoula, MT 59812–1195
(406) 243–6700 Fax: (406) 243–2060

## NEBRASKA

**UNIV. OF NEBRASKA – LINCOLN**
D.L. Love Memorial Library
Lincoln, NE 68588–0410
(402) 472–2562 Fax: (402) 472–5131

## NEVADA

**THE UNIV. OF NEVADA LIBRARIES**
Business and Govt. Information Center
Reno, NV 89557–0044
(702) 784–6579 Fax: (702) 784–1751

## NEW JERSEY

**NEWARK PUBLIC LIBRARY**
Science Div. – Public Access
P.O. Box 630
Five Washington Street
Newark, NJ 07101–7812
(201) 733–7782 Fax: (201) 733–5648

## NEW MEXICO

**UNIV. OF NEW MEXICO**
General Library
Govt. Information Dept.
Albuquerque, NM 87131–1466
(505) 277–5441 Fax: (505) 277–6019

**NEW MEXICO STATE LIBRARY**
325 Don Gaspar Avenue
Santa Fe, NM 87503
(505) 827–3824 Fax: (505) 827–3888

## NEW YORK

**NEW YORK STATE LIBRARY**
Cultural Education Center
Documents/Gift & Exchange Section
Empire State Plaza
Albany, NY 12230–0001
(518) 474–5355 Fax: (518) 474–5786

## NORTH CAROLINA

**UNIV. OF NORTH CAROLINA – CHAPEL HILL**
Walter Royal Davis Library
CB 3912, Reference Dept.
Chapel Hill, NC 27514–8890
(919) 962–1151 Fax: (919) 962–4451

## NORTH DAKOTA

**NORTH DAKOTA STATE UNIV. LIB.**
Documents
P.O. Box 5599
Fargo, ND 58105–5599
(701) 237–8886 Fax: (701) 237–7138

**UNIV. OF NORTH DAKOTA**
Chester Fritz Library
University Station
P.O. Box 9000 – Centennial and University Avenue
Grand Forks, ND 58202–9000
(701) 777–4632 Fax: (701) 777–3319

## OHIO

**STATE LIBRARY OF OHIO**
Documents Dept.
65 South Front Street
Columbus, OH 43215–4163
(614) 644–7051 Fax: (614) 752–9178

## OKLAHOMA

**OKLAHOMA DEPT. OF LIBRARIES**
U.S. Govt. Information Division
200 Northeast 18th Street
Oklahoma City, OK 73105–3298
(405) 521–2502, ext. 253
Fax: (405) 525–7804

**OKLAHOMA STATE UNIV.**
Edmon Low Library
Stillwater, OK 74078–0375
(405) 744–6546 Fax: (405) 744–5183

## OREGON

**PORTLAND STATE UNIV.**
Branford P. Millar Library
934 Southwest Harrison
Portland, OR 97207–1151
(503) 725–4123 Fax: (503) 725–4524

## PENNSYLVANIA

**STATE LIBRARY OF PENN.**
Govt. Publications Section
116 Walnut & Commonwealth Ave.
Harrisburg, PA 17105–1601
(717) 787–3752 Fax: (717) 783–2070

## SOUTH CAROLINA

**CLEMSON UNIV.**
Robert Muldrow Cooper Library
Public Documents Unit
P.O. Box 343001
Clemson, SC 29634–3001
(803) 656–5174 Fax: (803) 656–3025

**UNIV. OF SOUTH CAROLINA**
Thomas Cooper Library
Green and Sumter Streets
Columbia, SC 29208
(803) 777–4841 Fax: (803) 777–9503

## TENNESSEE

**UNIV. OF MEMPHIS LIBRARIES**
Govt. Publications Dept.
Memphis, TN 38152–0001
(901) 678–2206 Fax: (901) 678–2511

## TEXAS

**TEXAS STATE LIBRARY**
United States Documents
P.O. Box 12927 – 1201 Brazos
Austin, TX 78701–0001
(512) 463–5455 Fax: (512) 463–5436

**TEXAS TECH. UNIV. LIBRARIES**
Documents Dept.
Lubbock, TX 79409–0002
(806) 742–2282 Fax: (806) 742–1920

## UTAH

**UTAH STATE UNIV.**
Merrill Library Documents Dept.
Logan, UT 84322–3000
(801) 797–2678 Fax: (801) 797–2677

## VIRGINIA

**UNIV. OF VIRGINIA**
Alderman Library
Govt. Documents
University Ave. & McCormick Rd.
Charlottesville, VA 22903–2498
(804) 824–3133 Fax: (804) 924–4337

## WASHINGTON

**WASHINGTON STATE LIBRARY**
Govt. Publications
P.O. Box 42478
16th and Water Streets
Olympia, WA 98504–2478
(206) 753–4027 Fax: (206) 586–7575

## WEST VIRGINIA

**WEST VIRGINIA UNIV. LIBRARY**
Govt. Documents Section
P.O. Box 6069 – 1549 University Ave.
Morgantown, WV 26506–6069
(304) 293–3051 Fax: (304) 293–6638

## WISCONSIN

**ST. HIST. SOC. OF WISCONSIN LIBRARY**
Govt. Publication Section
816 State Street
Madison, WI 53706
(608) 264–6525 Fax: (608) 264–6520

**MILWAUKEE PUBLIC LIBRARY**
Documents Division
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 286–3073 Fax: (414) 286–8074

# Typical Report Citation and Abstract

❶ 19970001126 NASA Langley Research Center, Hampton, VA USA
❷ Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes
❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
❹ Mar. 1996; 130p; In English
❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10' to 50', and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65' swept forebody serrations tended to roll together, while vortices from 40' swept serrations were more effective in generating additional lift caused by their more independent nature.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

## Key

1. Document ID Number; Corporate Source
2. Title
3. Author(s) and Affiliation(s)
4. Publication Date
5. Contract/Grant Number(s)
6. Report Number(s); Availability and Price Codes
7. Abstract
8. Abstract Author
9. Subject Terms

# AERONAUTICAL ENGINEERING

*A Continuing Bibliography (Suppl. 391)*

JANUARY 8, 1999

## 01
## AERONAUTICS

19990004398 Academy of Sciences (USSR), Inst. of Theoretical and Applied Mechanics, Novosibirsk, USSR
**International Conference on the Methods of Aerophysical Research: Proceedings, Part 2**
Jan. 1998; 231p; In English; Methods of Aerophysical Research, 29 Jun. - 3 Jul. 1998, Novosibirsk, Russia
Contract(s)/Grant(s): F61775-98-WE002
Report No.(s): AD-A354010; CSP-98-1025-Pt-2; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The Final Proceedings for International Conference on Methods of Aerophysical Research (ICMAR'98), 29 June 1998 - 3 July 1998 This is an interdisciplinary conference. Topics include: Problems of Modeling at sub/trans/super/hypersonic velocities: Methods of flow diagnostics; Instrumentation for aerophysical experiments; and Verification of CFD models and methods. DTIC

*Conferences; Aerodynamics; Aerodynamic Characteristics*

19990007836 Advisory Group for Aerospace Research and Development, Mission Systems Panel, Neuilly-Sur-Seine, France
**System Design Considerations for Unmanned Tactical Aircraft (UTA)** ***Les Considerations dans les Projects de Systemes pour les Aeronefs Tactiques et Non Pilotes***
Jul. 1998; 292p; In English; In French; 8th; Mission Systems Panel Symposium, 7-9 Oct. 1997, Athens, Greece; Also announced as 19990007837 through 19990007863; Original contains color illustrations
Report No.(s): AGARD-CP-594; ISBN 92-836-0057-6; Copyright Waived; Avail: CASI; A13, Hardcopy; A03, Microfiche

This volume contains the Technical Evaluation Report, the Keynote Address and the 26 unclassified papers, presented at the Mission Systems Panel 8th Symposium held in Amfithea (Athens) Greece from 7th to 9th October 1997. The papers presented covered the following headings: (1) Applications; (2) Operational Concepts I & II; (3) Advances in UTA Techniques and Technologies (NAV, C(sup 3)I, G&C); and (4) Advances in UTA Techniques and Technologies (Sensors, Processing, Data Fusion). Author

*Conferences; Pilotless Aircraft; Systems Engineering; Aircraft Design; Tacan*

19990007842 Lockheed Martin Tactical Aircraft Systems, Fort Worth, TX USA
**Design Considerations for Future Unihabited Combat Air Vehicles**
Chaput, Armand J., Lockheed Martin Tactical Aircraft Systems, USA; Jul. 1998; 12p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A potential shortfall in U.S. tactical aircraft inventories required to meet future national and international defense contingency requirements early in the next century is projected to materialize some time during the period 2005-2015. The Uninhabited Combat Air Vehicle (UCAV) system concept has potential to help resolve the projected inventory shortfall. Lockheed Martin Tactical Aircraft Systems (LMTAS) studies have identified a number of potential roles and missions in which the UCAV should he both cost and operationally effective. The UCAV concept, however, is unproven and needs system concept technology development, evaluation and demonstration if it is to be considered a viable candidate to meet the projected shortfall. A near-term development program that includes overall system simulation, evaluation and demonstration in combination with configuration specific and advanced technology development (ATD) will ensure that defense planners have a viable alternative ready for decision by the time the projected shortfall materializes.
Author

*Pilotless Aircraft; Remotely Piloted Vehicles; Design Analysis; Systems Integration; Systems Analysis; Fighter Aircraft*

19990007899 NASA Scientific and Technical Information Facility, Baltimore-Washington International Airport,MD USA
**Aeronautical Engineering: A Continuing Bibliography with Indexes, Supplement 389**
Dec. 11, 1998; 80p; In English
Report No.(s): NASA/SP-1998-7037/SUPPL389; NAS 1.21:7037/SUPPL389; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This supplemental issue of Aeronautical Engineering, A Continuing Bibliography with Indexes (NASA/SP-1998-7037) lists reports, articles, and other documents recently announced in the NASA STI Database. The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract.
CASI
*Aeronautical Engineering; Aerodynamics; Bibliographies; Indexes (Documentation)*

19990008041 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA
**A Study of Uranus' Bow Shock Motions Using Langmuir Waves**
Xue, S., Iowa Univ., USA; Cairns, I. H., Iowa Univ., USA; Smith, C. W., Delaware Univ., USA; Gurnett, D. A., Iowa Univ., USA; Journal of Geophysical Research; Apr. 01, 1996; ISSN 0148-0227; Volume 101, No. A4, pp. 7659-7676; In English
Contract(s)/Grant(s): JPL-959193; JPL-959167; NAGw-2040; NAGw-3445; NSF ATM-90-21985
Report No.(s): Paper-95JA03849; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

During the Voyager 2 flyby of Uranus, strong electron plasma oscillations (Langmuir waves) were detected by the plasma wave instrument in the 1.78-kHz channel on January 23-24, 1986, prior to the inbound bow shock crossing. Langmuir waves are excited by energetic electrons streaming away from the bow shock. The goal of this work is to estimate the location and motion of Uranus' bow shock using Langmuir wave data, together with the spacecraft positions and the measured interplanetary magnetic field. The following three remote sensing analyses were performed: the basic remote sensing method, the lag time method, and the trace-back method. Because the interplanetary magnetic field was highly variable, the first analysis encountered difficulties in obtaining a realistic estimation of Uranus' bow shock motion. In the lag time method developed here, time lags due to the solar wind's finite convection speed are taken into account when calculating the shock's standoff distance. In the new trace-back method, limits on the standoff distance are obtained as a function of time by reconstructing electron paths. Most of the results produced by the latter two analyses are consistent with predictions based on the standard theoretical model and the measured solar wind plasma parameters. Differences between our calculations and the theoretical model are discussed.
Author
*Observation; Uranus (Planet); Bow Waves; Shock Waves; Plasma Oscillations; Mathematical Models; Electron Plasma*

## 02
## AERODYNAMICS

*Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.*

19990004152 Instituto Nacional de Tecnica Aeroespacial, Torrejon de Ardoz, Spain
**Computations of DFVLR-F4 Model Using a Viscous Flow Solver for Transonic Wings**
Varona, Jose Jimenez, Instituto Nacional de Tecnica Aeroespacial, Spain; Jun. 02, 1998; 65p; In English
Report No.(s): AT/TNO/4510/001/INTA/98; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Some theoretical results of the DFVLR-F4 Model obtained with a viscous flow solver for transonic wings are shown in this document. These calculation have been done under the AEREA F4 Model Test Programme. It is intended the assessment of CFD codes, using the information from the experiments of the DFVLR-F4 model at low and high Reynolds numbers. In the present paper, some comparisons with experimental results obtained at a Reynolds number of 3.0. 10(exp 6) are included. The code utilized is a viscous flow solver, which uses a direct iterative method, coupling an inviscid solver to an integral boundary layer method. The inviscid solver have been widely improved along 1996-97. These modifications have contributed to an improvement of the theoretical results when compared with the experimental ones. The results obtained at present show some lacks of the code in predicting the skin friction coefficient and in the computation of the laminar part of the wing. The absence of body effects leads to some differences in the predicted pitching moment, and in the slope of the lift coefficient. The possibilities of the code to improve the accuracy of the current solutions have been addressed. The boundary layer code has been improved at DLR, in order to compute the laminar part of the wing, and to include a transition criteria. Additionally, a better numerical solution has been

implemented. INTA and DLR are preparing an agreement of cooperation to develop a code which will use the improved flow solver developed at INTA and the improved boundary layer code developed at DLR. Additionally, other possibilities of improvement will be explored. The results obtained at present permit us to be confident in the possibilities of the code, which could give reasonable results at low computing times. The information of the ETW test campaign during December 1997 will help to validate the new results.
Author
*Computation; Numerical Analysis; Models; Wings; Transonic Flow*

19990007788 ESDU International Ltd., London, UK
**Effect of Angle of Attack on the Base Axial Force and Drag of Cylindrical Bodies with Conical Boat-Tails**
Dec. 1996; 12p; In English; Included in the Aerodynamics Sub-series.
Report No.(s): ESDU-96033; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham Street, London, N1 6UA, England), Hardcopy, Microfiche

ESDU 96033 presents an empirical method applying to cylindrical bodies with or without conical boat-tails, at angles of attack up to 25 degrees and Mach numbers up to 5. The method requires a value of the base drag at zero angle of angle of attack which may be obtained from ESDU 76033, 78041 and 79022 for subsonic, transonic and supersonic speeds, respectively. There must be at least three diameters of cylindrical section upstream of the boat-tail and the boundary layer must be fully turbulent. The method is accurate to within 0.03 in axial force coefficient based on body maximum cross section. Comparisons of predicted with experimental results are shown. A worked example illustrates the use of the method.
Author
*Angle of Attack; Axial Loads; Aerodynamic Drag; Cylindrical Bodies; Conical Nozzles*

19990007790 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
**Modelling of Airfoil-Vortex Interaction and Application to a Helicopter Rotor. Contribution to Blade-Vortex Interaction Noise Prediction** ***Modelisation de l'Interaction Profil-Tourbillon et Application au Rotor d'Helicoptere. Contribution a la Prevision du Bruit d'Interaction Pale-Tourbillon***
Rahier, Gilles, Office National d'Etudes et de Recherches Aerospatiales, France; Feb. 1998; ISSN 0078-3780; 218p; In English
Report No.(s): ONERA-PB-1998-1; ESA-TT-1354; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This thesis comes under the scope of work relating to the blade-vortex interaction noise from a helicopter main rotor. It deals with the prediction of blade pressure fluctuations which are the main sources of sound produced by these interactions. Part 1 deals with the study of two-dimensional airfoil-vortex interaction in an inviscid incompressible fluid. The calculations are performed using integral method and take into account vortex deformation during strong interactions. Several ways of modelling the vortex are studied and their influence on the response of the airfoil is analysed. The predictions are compared with other theoretical results and with experiment. The method of calculation is then employed to highlight the role of the main parameters in strong interaction. In part 2, it is applied to a helicopter rotor, after transposing the actual 3D problem into a multi-2D problem. The position and circulation of the vortices are obtained by modelling blade wake roll-up. A law for the evolution of their viscous radius is proposed. The effects of finite wingspan and compressibility are introduced by means of corrections. The approach is validated by comparisons with experiment in the case of a rotor interacting with a prescribed vortex and in that of a rotor interacting with the vortices from its wake. to conclude, the computational capabilities and limitations are summarized and future prospects.
Author
*Blade-Vortex Interaction; Airfoils; Computer Systems Performance; Computer Techniques; Noise Prediction; Rotors*

19990007832 NASA Langley Research Center, Hampton,VA USA
**Tetrahedral Finite-Volume Solutions to the Navier-Stokes Equations on Complex Configurations**
Frink, Neal T., NASA Langley Research Center, USA; Pirzadeh, Shahyar Z., NASA Langley Research Center, USA; Dec. 1998; 16p; In English; 10th; Finite Elements in Fluids, 5-8 Jan. 1998, Tucson, AZ, USA
Contract(s)/Grant(s): RTOP 522-31-21-2O
Report No.(s): NASA/TM-1998-208961; L-17783; NAS 1.15:208961; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A review of the algorithmic features and capabilities of the unstructured-grid flow solver USM3Dns is presented. This code, along with the tetrahedral grid generator, VGRIDns, is being extensively used throughout the U.S. for solving the Euler and Navi-

er-Stokes equations on complex aerodynamic problems. Spatial discretization is accomplished by a tetrahedral cell-centered finite-volume formulation using Roe's upwind flux difference splitting. The fluxes are limited by either a Superbee or MinMod limiter. Solution reconstruction within the tetrahedral cells is accomplished with a simple, but novel, multidimensional analytical formula. Time is advanced by an implicit backward-Euler time-stepping scheme. Flow turbulence effects are modeled by the Spalart-Allmaras one-equation model, which is coupled with a wall function to reduce the number of cells in the near-wall region of the boundary layer. The issues of accuracy and robustness of USM3Dns Navier-Stokes capabilities are addressed for a flat-plate boundary layer, and a full F-16 aircraft with external stores at transonic speed.
Author

*Finite Volume Method; Flux Difference Splitting; Mathematical Models; Navier-Stokes Equation; Turbulent Boundary Layer; Computational Fluid Dynamics; Unstructured Grids (Mathematics); Euler Equations of Motion; Turbulent Flow; Applications Programs (Computers); Grid Generation (Mathematics)*

19990008037 NASA Langley Research Center, Hampton, VA USA

**Global Nonlinear Parametric Modeling with Application to F-16 Aerodynamics**

Morelli, Eugene A., NASA Langley Research Center, USA; 1998; 6p; In English; Control, 24-26 Jun. 1998, Philadelphia, PA, USA

Report No.(s): ACC-I-98010-2; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A global nonlinear parametric modeling technique is described and demonstrated. The technique uses multivariate orthogonal modeling functions generated from the data to determine nonlinear model structure, then expands each retained modeling function into an ordinary multivariate polynomial. The final model form is a finite multivariate power series expansion for the dependent variable in terms of the independent variables. Partial derivatives of the identified models can be used to assemble globally valid linear parameter varying models. The technique is demonstrated by identifying global nonlinear parametric models for nondimensional aerodynamic force and moment coefficients from a subsonic wind tunnel database for the F-16 fighter aircraft. Results show less than 10% difference between wind tunnel aerodynamic data and the nonlinear parameterized model for a simulated doublet maneuver at moderate angle of attack. Analysis indicated that the global nonlinear parametric models adequately captured the multivariate nonlinear aerodynamic functional dependence.
Author

*F-16 Aircraft; Orthogonal Functions; Mathematical Models; Multivariate Statistical Analysis; Aerodynamic Coefficients; Aerodynamic Forces*

19990008181 Lockheed Martin Tactical Aircraft Systems, Fort Worth, TX USA

**Numerical Stability and Control Analysis Towards Falling-Leaf Prediction Capabilities of Splitflow for Two Generic High-Performance Aircraft Models**

Charlton, Eric F., Lockheed Martin Tactical Aircraft Systems, USA; Sep. 1998; 58p; In English

Contract(s)/Grant(s): NAS1-96014; RTOP 522-22-31-01

Report No.(s): NASA/CR-1998-208730; NAS 1.26:208730; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Aerodynamic analysis are performed using the Lockheed-Martin Tactical Aircraft Systems (LMTAS) Splitflow computational fluid dynamics code to investigate the computational prediction capabilities for vortex-dominated flow fields of two different tailless aircraft models at large angles of attack and sideslip. These computations are performed with the goal of providing useful stability and control data to designers of high performance aircraft. Appropriate metrics for accuracy, time, and ease of use are determined in consultations with both the LMTAS Advanced Design and Stability and Control groups. Results are obtained and compared to wind-tunnel data for all six components of forces and moments. Moment data is combined to form a "falling leaf" stability analysis. Finally, a handful of viscous simulations were also performed to further investigate nonlinearities and possible viscous effects in the differences between the accumulated inviscid computational and experimental data.
Author

*Aerodynamic Characteristics; Aircraft Models; Aircraft Performance; Angle of Attack; Computational Fluid Dynamics; Design Analysis; Fighter Aircraft; Supersonic Aircraft*

## 03
## AIR TRANSPORTATION AND SAFETY

*Includes passenger and cargo air transport operations; and aircraft accidents.*

19990004140 LB and M Associates, Inc., Oklahoma City, OK USA
**Analysis of Ditching and Water Survival Training Programs of Major Airframe Manufacturers and Airlines** *Final Report*
Cosper, Donna K., LB and M Associates, Inc., USA; McLean, Garner A., Civil Aeromedical Inst., USA; Jul. 1998; 36p; In English
Contract(s)/Grant(s): DTFA02-94-T-80076; FAA Proj. AM-B-94-PRS-89
Report No.(s): DOT/FAA/AM-98/19; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Current transport category aircrew training programs related to ditching and water survival are reviewed for content and attention to data. This activity resulted from industry and regulatory inquiries about the state- of-the-art in ditching and water survival operations, especially with regard to the increasing number of aircraft operations, and associated opportunities for emergency water landing events, that the future will bring. The information on water landing events was gathered from published reports related to these issues. For example, Johnson (1984) cited 16 transport category water landings that occurred during the period from 1959 to 1979, and Chen and Muller (1994) reported that 33 water-impact accidents occurred in commuter category aircraft from 1982 until 1989. An additional 21 water-related accidents or near idents occurred in transport a raft from 1980 through 1994. Training materials related to ditching and water survival were provided by six major airframe manufacturers and nine major airlines. The purpose of the study was to examine the information flight attendants, as well as passengers, are provided about ditching and water survival equipment and procedures, to determine if existing training practices are satisfactory. Special emphasis is placed on unplanned water landing events. The resulting analysis identifies deficiencies in both water survival equipment and procedures, and recommends solutions designed to promote more advanced water landing and water survival operations.
Author
*Water Landing; Survival; Passengers; Flight Operations; Emergencies; Commuter Aircraft; Commercial Aircraft; Airline Operations*

19990004384 Federal Aviation Administration, Washington, DC USA
**Notices to Airmen: Domestic/International, September 10, 1998**
Sep. 10, 1998; 214p; In English
Report No.(s): PB99-104325; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Table of contents: Airway notams; Airports, facilities, and procedural Notams; General FDC Notams; Part 95 Revisions to minimum en route IFR altitudes and changeover points; International Notices to Airmen; Graphic notices.
NTIS
*National Airspace System; Air Navigation; Charts; Runways; Airports*

19990004385 Federal Aviation Administration, Washington, DC USA
**Notices to Airmen: Domestic/International, May 21, 1998**
May 21, 1998; 210p; In English
Report No.(s): PB99-104317; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Table of contents: Airway notams; Airports, facilities, and procedural Notams; General FDC Notams; Part 95 Revisions to minimum en route IFR altitudes and changeover points; International Notices to Airmen; Graphic notices.
NTIS
*National Airspace System; Air Navigation; Charts; Runways; Airports; Routes*

19990005047 CFD Research Corp., Huntsville, AL USA
**Computational Fluid Dynamics Tools for Escape Systems Aerodynamic Analysis, Volume 2 of 2** *Final Report*
habchi, S. D.; Rock, S. G.; Hufford, G. S.; Parsatharsay, V. J.; Przekwas, A. J.; Feb. 09, 1998; 165p; In English
Contract(s)/Grant(s): N62269-92-C-0248
Report No.(s): AD-A353755; CFDRC-4128/17; NAWCADPAX-97-257-TR; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This report documents the findings of a SBIR Phase II study entitled "CFD Analysis of Drag Reduction on an Ejection Seat During High Speed Ejection". The main objectives of this study were to develop and validate Computational Fluid Dynamics (CFD) methodologies for comprehensive aerodynamic analysis of ejection seat and occupant in free flight, and develop and adapt

existing CFD technologies for analysis of ejection seat in proximity of aircraft for both steady-state and unsteady seat and aircraft separation using prescribed trajectory.
DTIC
*Computational Fluid Dynamics; Escape Systems; Aerodynamic Characteristics; Ejection; Ejection Seats; Free Flight; Design Analysis*

19990005048 CFD Research Corp., Huntsville, AL USA
**Computational Fluid Dynamics Tools for Escape Systems Aerodynamic Analysis, Volume 1 of 2** *Final Report*
habchi, S. D.; Rock, S. G.; Hufford, G. S.; Parsatharsay, V. J.; Przekwas, A. J.; Feb. 09, 1998; 129p; In English
Contract(s)/Grant(s): N62269-92-C-0248
Report No.(s): AD-A353756; CFDRC-4128/17; NAWCADPAX-97-257-TR; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report documents the findings of a SBIR Phase II study entitled "CFD Analysis of Drag Reduction on an Ejection Seat During High Speed Ejection". The main objectives of this study were to develop and validate Computational Fluid Dynamics (CFD) methodologies for comprehensive aerodynamic analysis of ejection seat and occupant in free flight, and develop and adapt existing CFD technologies for analysis of ejection seat in proximity of aircraft for both steady-state and unsteady seat and aircraft separation using prescribed trajectory.
DTIC
*Aerodynamic Characteristics; Computational Fluid Dynamics; Ejection Seats; Ejection; Escape Systems; Design Analysis*

19990007921 NASA Goddard Space Flight Center, Greenbelt, MD USA
**A Future of Satellite-Aided Search and Rescue**
Wallace, Ronald, NASA Goddard Space Flight Center, USA; 1998; 9p; In English; Radio Technical Commission for Maritime Services Assembly, 11-15 May 1998, San Diego, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Satellite technology has been an integral part of maritime search and rescue since the COSPAS-SARSAT system began operation in 1984. This system, credited with more than eighty-six hundred lives saved, has recently been augmented to provide immediate response through geostationary satellites. The other satellite-based distress alerting system, INMARSAT, launched its emergency Standard C service in 1991 and Standard E in 1997. Current plans call for a continuation of service from both of these vital systems at least through the first decade of the next century. We are currently witnessing the construction of a number of new satellite systems that will have the potential for revolutionizing mobile communications. These systems will be capable of emergency communication, and must be given due consideration in any look at the future, This paper reviews existing systems using satellites for distress alerting, describes the plans in place for them, and discusses likely developments.
Author
*Inmarsat Satellites; Mobile Communication Systems; Rescue Operations; Synchronous Platforms; SARSAT; COSPAS*

19990008228 National Transportation Safety Board, Washington, DC USA
**National Transportation Safety Board: Aircraft Accident Report. In-Flight Fire/Emergency Landing Federal Express Flight 1406 Douglas DC-10-10, N68055, Newburgh, New York, September 5, 1996**
Jan. 01, 1998; 148p; In English
Report No.(s): PB98-910403; NTSB/AAR-98/03; DCA-96-MA-07-9; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report explains the accident involving Federal Express flight 1406, a Douglas DC-10-10, which made an emergency landing at Stewart International Airport on September 5, 1996, after the flightcrew determined that there was smoke in the cabin cargo compartment. Safety issues in the report include flightcrew performance of emergency procedures, undeclared hazardous materials in transportation, dissemination of hazardous materials information, airport emergency response, and adequacy of aircraft interior firefighting methods.
NTIS
*Safety; Safety Management; Aircraft Accident Investigation; Aircraft Accidents; Fires; Emergencies; Air Transportation*

19990008229 National Transportation Safety Board, Washington, DC USA
**National Transportation Safety Board Transportation Initial Decisions and Orders and Board Opinions and Orders: Adopted and Issued during the Month of August, 1998**
Aug. 1998; 328p; In English
Report No.(s): PB98-916708; NTSB/IDBOO-98/08; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

This publication contains all Judge Initial Decisions and Board Opinions and Orders in Safety Enforcement and Seaman Enforcement Cases for August 1998.
NTIS
*Safety Management; Air Transportation*

19990008258 European Organization for the Safety of Air Navigation, Experimental Centre, Bretigny-sur-Orge, France
**Gears Conflict Resolution Algorithm**
Irvine, R., European Organization for the Safety of Air Navigation, France; Nov. 1997; 58p; In English
Report No.(s): PB99-101024; EEC-321; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An algorithm is described which finds a set of flyable, conflict-free trajectories for an aircraft which must fly through an environment containing obstacle aircraft whose trajectories are known. The algorithm makes systematic use of a maneuver generator and a conflict detector. The maneuver generator may embody a variety of aircraft behavior models which might, for example, take into account standard turn behavior and wind predictions. The conflict detector may embody a variety of definitions of what makes a trajectory unacceptable, and might, for example, take into account growing uncertainty in the future positions of aircraft. Correctness of solution trajectories is readily demonstrable. The algorithm is primarily intended for use in free-flight air traffic control simulations but might also be used in operational applications (ground or air-based) should conflict resolution assistance be required. In an automated simulation a solution trajectory can be chosen from the resulting set of conflict-free trajectories in accordance with optimization criteria. The algorithm may be used for prioritized planning of the motion of a number of aircraft. It may also be used to solve motion-planning problems in domains other than air traffic control.
NTIS
*Gears; Algorithms; Air Traffic Control; Congestion; Separation; Trajectory Optimization; Flight Paths*

## 04
## AIRCRAFT COMMUNICATIONS AND NAVIGATION

*Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.*

19990004631 Smithsonian Astrophysical Observatory, Cambridge, MA USA
**Analysis of Spaceborne GPS Systems** *Final Report, 12 Sep. 1997 - 11 Mar. 1998*
Cosmo, Mario L., Smithsonian Astrophysical Observatory, USA; Davis, James L., Smithsonian Astrophysical Observatory, USA; Elosegui, Pedro, Smithsonian Astrophysical Observatory, USA; Hill, Michael, Smithsonian Astrophysical Observatory, USA; ScireScapuzzo, Francesca, Smithsonian Astrophysical Observatory, USA; 1998; 18p; In English
Contract(s)/Grant(s): NAG1-1969; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A reasonable amount of literature can be found on the general topic of GPS receiving antennas, but very little has been published on spaceborne GPS receiving antennas. This very new topic seems to be so far more of interest for the industrial world than for the academic community. For satellite applications, microstrip antennas are usually preferred over other types of antennas mainly because of their non-electrical characteristics, such as small size, relatively lightweight, shape, possibility of integration with microwave integrated circuits, and relatively low costs. Careful design of patch antennas could meet all the requirements (electrical and non-electrical) of GPS receiving antenna to be mounted on a tethered satellite.
Derived from text
*Global Positioning System; Research; Spaceborne Experiments; Antenna Design; Spacecraft Antennas; Satellite Antennas*

19990004640 Civil Aeromedical Inst., Oklahoma City, OK USA
**Aircraft Importance and Its Relevance to Situation Awareness** *Final Report*
Gronlund, Scott D., Oklahoma Univ., USA; Ohrt, Daryl D., Oklahoma Univ., USA; Dougherty, Michael R. P., Oklahoma Univ., USA; Perry, Jennifer L., Oklahoma Univ., USA; Manning, Carol A., Civil Aeromedical Inst., USA; May 1998; 16p; In English
Report No.(s): DOT/FAA/AM-98/16; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We tested en route air traffic controllers (currently serving as instructors at the FAA Academy) to determine what they remember about the aircraft in their sector. We focused on memory for flight data (especially aircraft altitude and ground speed) and the position of the aircraft on the radar screen. Aircraft importance affected memory for flight data but not the highly accurate recall of the radar position of the aircraft. We hypothesize that controllers use their excellent memory for aircraft position to classify

aircraft as important (potential traffic) or not, and better remember flight data about important aircraft (in particular, their exact altitude). The results have implications for improving techniques to assess situation awareness and interfaces to support it.
Author
*Air Traffic Controllers (Personnel); Instructors; Memory*

19990005953 Civil Aeromedical Inst., Oklahoma City, OK USA
**The Combination of Flight Count and Control Time as a New Metric of Air Traffic Control Activity** *Final Report*
Mills, Scott H., Civil Aeromedical Inst., USA; May 1998; 16p; In English
Report No.(s): DOT/FAA/AM-98/15; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The exploration of measures of airspace activity is useful in a number of significant ways, including the establishment of baseline air traffic control (ATC) measures and the development of tools and procedures for airspace management. This report introduces a new metric of ATC activity that combines two existing measures (flight count and the time aircraft are under control). The Aircraft Activity Index (AAI) is sensitive to changes in both flight count and flight length, and therefore is a superior measure for comparing aircraft activity between two epochs of time. The AAI was applied to data from 10 days of System Analysis Recordings obtained from the Seattle Air Route Control Center. The advantages of the AAI were most apparent when different aircraft types consistently had different mean flight lengths. Possible uses of the AAI and other ATC measures for the evaluation of new systems and procedures are discussed.
Author
*Air Traffic Control; Systems Analysis; Time Measurement; Airspace*

19990007797 Instituto Nacional de Pesquisas Espacias, Dept. Mecanica Espacial e Controle, Sao Jose dos Campos, Brazil
**Utilization of the Navigation Solution from the GPS to Determine the Orbit of a Satellite in a Low Orbit** *Utilizacao da Solucao de Navegacao do GPS para Determinacao de Orbita de Satelites a Baixa Altitude*
doNascimento, Jorge Martins, Instituto Nacional de Pesquisas Espacias, Brazil; Kuga, Helio Koiti, Instituto Nacional de Pesquisas Espacias, Brazil; deAlmeidaPrado, Antonio Fernando Bertachini, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 9p; In Portuguese; 14th; Engenharia Mecanica, 8-12 Dec. 1997, Bauru, Brazil
Report No.(s): INPE-6719-PRE/2741; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this work the orbit determination problem of an earth artificial satellite is analyzed. This problem is solved using the GPS (Global Positioning System). It is assumed that the target satellite will carry a GPS receiver. To perform this mission, one needs to perform the following steps: (1) to simulate the m the GPS and the target satellites; (2) to calculate all the distances between the GPS satellites and the target satellite; (3) to determine which GPS satellites are visible; (4) to corrupt those data by adding a random error; (5) to develop a software that is able to get a navigation solution on each point of the orbit; and (6) to develop a new software to get the target satellite state vector (position and velocity) from the navigation solution. This work was motivated by INPE's plans of performing this kind of mission in a near future. It must he emphasized that the goal of this work is not to provide the system maximum accuracy, but a sufficient accuracy to track and control the satellite at a low cost.
Author
*Navigation Satellites; Global Positioning System; Orbit Calculation; Artificial Satellites*

19990007855 Daimler-Benz Aerospace A.G., Military Aircraft, Ottobrunn, Germany
**Reliable Autonomous Precise Integrated Navigation RAPIN for Present and Future Air-Vehicles**
Koehler, Thomas, Daimler-Benz Aerospace A.G., Germany; Tumbraegel, Franz, Daimler-Benz Aerospace A.G., Germany; Beyer, Juergen, Honeywell Regelsysteme G.m.b.H., Germany; Jul. 1998; 16p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The operation of unmanned vehicles ranging from strategic missions of autonomous high altitude reconnaissance to tactical missions of reconnaissance and strike/attack impose new requirements to the guidance systems in the area of reliability and safety. This includes all phases of the mission start, cruise, attack/strike and 'Low Level' operation including precision approaches even under bad weather conditions and in a hostile environment. A reliable, continuous and precise navigation system is of paramount importance for the guidance function even more for unmanned air vehicles. The Project RAPIN, the name standing for 'Reliable Autonomous Precise Integrated Navigation', combines the navigational research activities at Daimler-Benz Aerospace AG (Dasa) Military Aircraft teamed with Honeywell Regelsysteme GmbH in that context. RAPIN integrates 'Laser Inertial Navigation System' (LINS), P(Y) code 'Global Positioning System' (GPS) and 'Terrain Referenced Navigation' system (TRN). The data fusion concept is to combine all available information in one MAIN filter gaining the highest accuracy. In order to provide uncontaminated backup solutions in case of sensor failures, a bank of SUB filters is working in parallel. Each SUB filter uses a different subset of sensor signals. It is the objective of this paper to report on the system concept, the design of the prototype, and to describe

the realization process. Subsequently, the paper will present first and preliminary results including flight trials on C-160 Transall ANA/FRA (Autonome Navigationsanlage/Flugregelungsanlage) performed by the "Wehrtechnische Dienststelle 61". The possible application of this generic system varies from uninhabited reconnaissance / fighter aircraft over transport aircraft to rescue helicopters.
Author
*Autonomous Navigation; Multisensor Fusion; Aircraft Guidance; Systems Integration; Pilotless Aircraft; Flight Management Systems; Air Navigation; Automatic Flight Control*

19990007856 Universitaet der Bundeswehr Muenchen, Inst. fuer Systemdynamik und Flugmechanik, Neubiberg, Germany
**Landmark Navigation and Autonomous Landing Approach with Obstacle Detection for Aircraft**
Fuerst, Simon, Universitaet der Bundeswehr Muenchen, Germany; Werner, Stefan, Universitaet der Bundeswehr Muenchen, Germany; Dickmanns, Dirk, Universitaet der Bundeswehr Muenchen, Germany; Dickmanns, Ernst-Dieter, Universitaet der Bundeswehr Muenchen, Germany; Jul. 1998; 12p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A machine perception system for aircraft and helicopters using multiple sensor data for state estimation is presented. by combining conventional aircraft sensors like gyros, accelerometers, artificial horizon, aerodynamic measuring devices and GPS with vision data taken by conventional CCD-cameras mounted on a pan and tilt platform, the position of the craft can be determined as well as the relative position to runways and natural landmarks. The vision data of natural landmarks are used to improve position estimates during autonomous missions. A built-in landmark management module decides which landmark should be focused on by the vision system, depending on the distance to the landmark and the aspect conditions. More complex landmarks like runways are modeled with different levels of detail that are activated dependent on range. A supervisor process compares vision data and GPS data to detect mis-tracking of the vision system e.g. due to poor visibility and tries to reinitialize the vision system or to set focus on another landmark available. During landing approach obstacles like trucks and airplanes can be detected on the runway. The system has been tested in real-time within a hardware-in-the-loop simulation. Simulated aircraft measurements corrupted by noise and other characteristic sensor errors have been fed into the machine perception system; the image processing module for relative state estimation was driven by computer generated imagery. Results from real-time simulation runs are given.
Author
*Navigation Instruments; State Estimation; Autonomous Navigation; Landmarks; Onboard Data Processing; Multisensor Fusion; Aircraft Landing; Instrument Landing Systems; Computer Vision; Obstacle Avoidance; Flight Simulation*

19990008059 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
**Precise Point Positioning for the Efficient and Robust Analysis of GPS Data From Large Networks**
Zumberge, J. F., Jet Propulsion Lab., California Inst. of Tech., USA; Heflin, M. B., Jet Propulsion Lab., California Inst. of Tech., USA; Jefferson, D. C., Jet Propulsion Lab., California Inst. of Tech., USA; Watkins, M. M., Jet Propulsion Lab., California Inst. of Tech., USA; Webb, F. H., Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Geophysical Research; Mar. 10, 1997; ISSN 0148-0227; Volume 102, No. B3, pp. 5005-5017; In English
Report No.(s): Paper-96JB03860; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Networks of dozens to hundreds of permanently operating precision Global Positioning System (GPS) receivers are emerging at spatial scales that range from 10(exp 0) to 10(exp 3) km. to keep the computational burden associated with the analysis of such data economically feasible, one approach is to first determine precise GPS satellite positions and clock corrections from a globally distributed network of GPS receivers. Then, data from the local network are analyzed by estimating receiver specific parameters with receiver-specific data; satellite parameters are held fixed at their values determined in the global solution. This "precise point positioning" allows analysis of data from hundreds to thousands of sites every day with 40 Mflop computers, with results comparable in quality to the simultaneous analysis of all data. The reference frames for the global and network solutions can be free of distortion imposed by erroneous fiducial constraints on any sites.
Author
*Global Positioning System; Data Acquisition; Networks; Receivers*

19990008185 Old Dominion Univ., Norfolk, VA USA
**Air Traffic Network Project** ***Final Report, 1996 - 1997***
1997; 6p; In English
Contract(s)/Grant(s): NAG1-1745
Report No.(s): NASA/CR-1997-207689; NAS 1.26:207689; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The high level requirement of the Air Traffic Network (ATN) project is to provide a mechanism for evaluating the impact of router scheduling modifications on a networks efficiency, without implementing the modifications in the live network.
Author
*Networks; Protocol (Computers); Network Synthesis; Telecommunication*

## 05
## AIRCRAFT DESIGN, TESTING AND PERFORMANCE

*Includes aircraft simulation technology.*

19990004075 RAND Corp., Santa Monica, CA USA
**The Cutting Edge: A Half Century of U.S. Fighter Aircraft R and D**
Lorell, Mark A., RAND Corp., USA; Levaux, Hugh P., RAND Corp., USA; Jan. 1998; 235p; In English
Contract(s)/Grant(s): F49642-96-C-0001
Report No.(s): AD-A354082; RAND-MR-939-AF; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Past and ongoing RAND research indicates that experience; i.e., the steady buildup and maintenance of expertise over time through constant learning by doing, is critical in the cost effective design and development of successful military aircraft. This proposition is, however, still subject to some debate; given its critical importance for choosing correct policies, more evidence on it would be very valuable. For example, achieving a better understanding of the role of experience in military aircraft R&D is crucial for determining how to maintain a viable U.S. industrial base for the future in an era of declining R&D budgets, few new program starts, and industry contraction. This book, and a companion document that concentrates on bomber R&D, analyze the role of experience in combat aircraft R&D through a systematic review of the historical record from the early 1940s to the present of the major prime contractors in developing new fighter and bomber aircraft, using openly available published sources. This research complements and supports other theoretical and historical research reported elsewhere.
DTIC
*Bomber Aircraft; Fighter Aircraft; Research and Development; Research Management; Federal Budgets*

19990004106 Old Dominion Univ., Coll. of Engineering and Technology, Norfolk, VA USA
**Analysis and Design of Fuselage Structures Including Residual Strength Prediction Methodology** *Final Report*
Knight, Norman F., Old Dominion Univ., USA; 1998; 135p; In English
Contract(s)/Grant(s): NAG1-1588
Report No.(s): NASA/CR-1998-208267; NAS 1.26:208267; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The goal of this research project is to develop and assess methodologies for the design and analysis of fuselage structures accounting for residual strength. Two primary objectives are included in this research activity: development of structural analysis methodology for predicting residual strength of fuselage shell-type structures; and the development of accurate, efficient analysis, design and optimization tool for fuselage shell structures. Assessment of these tools for robustness, efficient, and usage in a fuselage shell design environment will be integrated with these two primary research objectives.
Derived from text
*Prediction Analysis Techniques; Fuselages; Structural Analysis*

19990004162 Army Aeromedical Research Lab., Fort Rucker, AL USA
**Design Issues for Helmet-Mounted Display Systems for Rotary-Wing Aviation** *Final Report*
Rash, Clarence E., Army Aeromedical Research Lab., USA; McLean, William E., Army Aeromedical Research Lab., USA; Mora, John C., Army Aeromedical Research Lab., USA; Ledford, Melissa H., Army Aeromedical Research Lab., USA; Mozo, Ben T., Army Aeromedical Research Lab., USA; Jul. 1998; 186p; In English
Contract(s)/Grant(s): Proj 30162787A879
Report No.(s): AD-A352464; USAARL-RN-98-32; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Since the 1970s, the trend in Army aviation has been to rely on helmet-mounted displays (HMDs) to provide the aircrew with pilotage imagery, flight information, and fire control imagery and symbology. This paper is intended to serve as both a checklist and a guide for designers of future integrated helmet and display systems for rotary-wing aircraft. In this paper: 1) salient performance parameters of such systems are identified; 2) recommendations for values of these parameters are suggested, based on past research and the opinions of subject matter experts; 3) an analysis of potential health and safety hazards is provided; 4) a human

factors engineering assessment (HFEA) is provided; and 5)lessons learned from previously fielded U.S. Army HMD systems are summarized. However, this paper is not a cookbook for building an integrated helmet and display system.
DTIC
*Helmet Mounted Displays; Rotary Wing Aircraft; Rotary Wings; Safety; Human Factors Engineering; Helmets*

19990004383 Galaxy Scientific Corp., Egg Harbor Township, NJ USA
**Health Hazards of Combustion Products from Aircraft Composite Materials** *Final Report*
Gandhi, S., Galaxy Scientific Corp., USA; Lyon, R. E., Galaxy Scientific Corp., USA; Sep. 1998; 36p; In English
Report No.(s): PB99-104499; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Concerns about the potential health hazards of burning fiber-reinforced polymer composites in aircraft fires parallel the rising usage of these materials for commercial aircraft primary and secondary structures. An overview of the nature and the potential hazards associated with airborne carbon fibers released during flaming combustion of aircraft composites is presented. The current data derived from animal studies are insufficient to determine the acute toxicity of carbon fibers from burning composites.
NTIS
*Combustion Products; Hazards; Health; Fiber Composites; Reinforcing Fibers*

19990005098 Lockheed Martin Tactical Aircraft Systems, Fort Worth, TX USA
**Large Area Composite Inspection System** *Final Report, Oct. 1992 - Jun. 1998*
Drake, Thomas E., Lockheed Martin Tactical Aircraft Systems, USA; Jun. 1998; 164p; In English
Contract(s)/Grant(s): F33615-92-C-5981; AF Proj. 3153
Report No.(s): AD-A353169; FZM-8250-19; AFRL-ML-WP-TR-1998-4128; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The Large Area Composite Inspection System (LACIS) successfully proved that Laser Ultrasonic Testing (UT) will meet the future needs of both Air Logistics Centers (ALC's) and aerospace contractors. Many significant advances in laser ultrasonic technology were demonstrated with the prototype system. Highlights of the program accomplishments are: large area complex composite structures were tested with Laser UT for the first time; rapid and accurate optical scanning was achieved; improved defect detection and signal-to-noise ratio was accomplished; and, advanced data analysis capabilities were demonstrated. Laser UT reduced the capital investment and lowers the labor cost of testing composite structures. The LACIS program conclusively demonstrated the superiority of Laser UT for testing large complex aerospace composite materials. Laser UT will be an important manufacturing and in-service method for Quality Assurance of next generation of advanced aircraft.
DTIC
*Composite Structures; Inspection; Lasers; Ultrasonic Tests; Logistics; Composite Materials; Aerospace Systems*

19990007837 Lockheed Martin Corp., Palmdale, CA USA
**Design Guidelines and Considerations for the UTA**
Nicolai, Leland M., Lockheed Martin Corp., USA; Jul. 1998; 10p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Unmanned Tactical Aircraft is viewed by many as the centerpiece for affordable tactical air warfare in the year 2020 due to its potential for a revolutionary reduction in LCC and the fact that it embodies most of the Aerospace 2020 technology initiatives. Most of the technology for making the UTA effective as a weapon system is here today, but the technology for realizing its potential cost reduction remains to be developed.
Author
*Pilotless Aircraft; Design Analysis; Cost Reduction*

19990007840 Naval Air Warfare Center, Weapons Div., China Lake, CA USA
**Highly Maneuverable Lethal Vehicle (HMLV) Concept**
Palfalvy, George M., Naval Air Warfare Center, USA; Andes, David K., Naval Air Warfare Center, USA; Siegel, David, Office of Naval Research, USA; Jul. 1998; 6p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The paper presents interim results of a technology feasibility study of an unoccupied, armed, reusable, semi-autonomous air weapon system- the Highly Maneuverable Lethal Vehicle (HMLV). The HMLV concept that is currently being studied nominally has the following characteristics: (1) Acceleration capability greater than that of any manned aircraft; (2) Sensors, sensor processing, automatic target recognition algorithms and reasoning/decision-making algorithms to allow it to operate almost completely autonomously; (3) A variable-bandwidth, jam-resistant data-link to communicate images to an offboard controller; (4) Light-

weight, inexpensive, but precision guided and highly lethal, weaponry to prosecute air and surface targets; and (5) Airborne refueling capability. The study's goal is to examine applicable technologies and determine where they are lacking so that research funding can be properly focused. Interim results indicate that: (1) High-g airframes can he built (range and loiter capability for these airframes may be an issue); (2) Turbojet engines that can withstand the high-g environment can be built; (3) Sensor and signal-processing research is progressing at a rate that will produce sufficient capability in the near future; (4) The high-g capability of the HMLV, combined with a simple infrared countermeasure, will allow it to evade most threat missiles; and (5) Advances in computational algorithms, including ATR, will be required.
Author
*Highly Maneuverable Aircraft; Pilotless Aircraft; Feasibility Analysis*

19990007844 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, Germany
**System Integrity Considerations for Unmanned Tactical Aircraft**
Scheithauer, D., Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Wunderlich, G., Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Jul. 1998; 12p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In general, unmanned aerial vehicles (UAVS) and Cruise Missiles (CM) have demonstrated their operational value in the limited conflicts of the last years. This experience and technological advances promise similar successful results for more sophisticated Unmanned Tactical Aircraft (UTA) covering a wider range of airborne mission roles. Throughout this publication the term UTA will be used in favor of the term uninhabited combat aerial vehicle (UCAV). In this paper UTA concepts are evaluated with respect to system integrity. In a first step mission scenarios are analyzed with respect to the hostile threats an UTA will encounter. These external threats together with internal threats affecting reliability and system safety are the reference for the evaluation of the required integrity levels. On the basis of a generic system architecture essential and non-essential functions are considered. The assessment led to the result that UTA will be quite complex. This will have a major impact on the life cycle costs according to the experience with manned aircraft programs. However, compared with manned aircraft weapon systems UTA life cycle costs will be lower due to fewer operating costs.
Author
*Cruise Missiles; Pilotless Aircraft; Systems Engineering; Weapon Systems; Design Analysis; Threat Evaluation*

19990007846 Wright Lab., Aeromechanics Integration Branch, Wright-Patterson AFB, OH USA
**Unconstrained Maneuver Air Vehicle: A Configuration Development**
Shenk, Barth W., Wright Lab., USA; Jul. 1998; 10p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Maneuverability-based sizing of a notional, unmanned air vehicle is presented with spin tunnel test results of a resultant configuration. Sustained load factor and roll acceleration were traded against wing loading, thrust-to-weight ratio and aspect ratio for a notional air-to-air combat mission. Prospective turn and roll performance goals were developed for an unmanned fighter, and physical limitations of thrust matching between cruise and maneuver power requirements was studied. The resulting configuration characteristics indicate that optimization of this class of vehicle requires development of inertial optimization methods and structural design methodologies for instantaneous, dynamic loads.
Author
*Highly Maneuverable Aircraft; Structural Design; Pilotless Aircraft; Optimization; Aircraft Configurations; Spin Tests; Aircraft Design*

19990007848 Papachristofilou (I.), Thessaloniki, Greece
**System Layout of an Unmanned High Altitude Aircraft for Certification and Flight in Civil Airspace**
Papachristofilou, I., Papachristofilou (I.), Greece; Kaempf, P., Daimler-Benz Aerospace A.G., Germany; Wagner, O., Technische Univ., Germany; Jul. 1998; 8p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Several unmanned air vehicles (UAVs) are currently in operation or under development, and predictions for the future indicate an expansion in the tasks that will be covered by UAVs. With missions conceivable both in the civil as well as military sectors, UAVs are expected to be procured and operated in increasing numbers in the immediate future. However, besides the technical challenges associated with unmanned flight, the issues of certification and rules of operation of unmanned aircraft in non-restricted airspace need to be addressed. Flights of unmanned aircraft are currently taking place within reserved airspace with only few exceptions where UAVs have been allowed to enter open airspace under special precautions. The potential of unmanned aircraft can only be exploited if such restrictions are lifted and they are certified to operate along manned aircraft. to reach such a

point, formulation of explicit certification requirements on the system design of the aircraft is required, as well as a series of flight tests to validate the concept of safe use of unmanned aircraft in non-restricted airspace. Although such regulations do not exist at the moment, airworthiness and air traffic control authorities have already started examining the issues involved and are expected to issue guidelines covering unmanned flight in the near future. Based on information available from the above mentioned authorities, the main characteristics of those regulations can be described at the present time. Moreover, the implications on the system design of unmanned aircraft can be highlighted, showing the parameters that are to influence future designs. In our view the least complicated route to the operation of unmanned aircraft in civil airspace can be explored with a subsonic high altitude reconnaissance platform. Here the relocation of the pilot to a ground station offers the highest benefits, creating a strong rationale for the development of such a craft. At the same time, only a limited number of additional subsystems are necessary to facilitate flight in open airspace, which will be demonstrated by means of a recently concluded conceptual design of an unmanned high altitude aircraft.
Author
*Pilotless Aircraft; Aircraft Design; Systems Engineering; Airspace; Control Systems Design*

19990007849 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
**Hypersonic Drone for Reconnaissance Missions in Depth** ***Drone Hypersonique pour des Missions de Reconnaissance en Profondeur***
Serre, L., Office National d'Etudes et de Recherches Aerospatiales, France; Jul. 1998; 10p; In French; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The concept of using a hypersonic drone aircraft operating at very high altitude is analyzed. One example of an operational flight is obtaining an important class of information which is difficult to obtain by other means. Of equal importance, the mounting of sensors is strongly connected with the size of the vehicle, and must, by this standard, be considered in the preliminary project for finalizing the main options.
Transl. by CASI
*Drone Aircraft; Hypersonic Aircraft; Reconnaissance*

19990008025 Stanford Univ., Dept. of Aeronautics and Astronautics, Stanford, CA USA
**Response and Failure of Composite Plates with a Bolt-Filled Hole** ***Interim Report***
Yan, U. M., Stanford Univ., USA; Sun, H. T., Stanford Univ., USA; Wei, W. D., Stanford Univ., USA; Chang, F. K., Stanford Univ., USA; Jun. 1998; 90p; In English
Report No.(s): PB99-104465; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This progress report summarizes the activities that have been performed under the sponsorship of the Federal Aviation Administration (FAA) under contract no. DEPT/95-G-012-0001 from May 1, 1996 to June 1, 1997. This program is considered to be a part of a special joint project between the FAA and the Boeing Company on the design of composite bolted joints. The major effort of the joint project is to develop the most advanced computer code for the analysis and design of bolted composite joints for the Boeing Company and the FAA. The major focus of the FAA program is on net-tension failure of composites containing a circular cutout with or without a mechanically tightened bolt, while the Boeing program focuses on the bearing damage of bolted joints in both double and single lap joints. This report describes the activities under FAA funding. Both experimental and analytical work have been conducted.
NTIS
*Failure; Composite Structures; Plates (Structural Members); Bolts*

19990008132 Research Inst. of National Defence, Div. of Defence Analysis, Stockholm, Sweden
**Outlook for the Russian Aircraft Industry 1997-2007** ***Utsikter foer den Tyska Flyplansindustrin 1997-2007***
Kogan, Evgeni, Research Inst. of National Defence, Sweden; Apr. 1998; 48p; In English
Report No.(s): PB99-102311; FOA-R-98-00755-170-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The study addresses one of the most important areas in the development of the Russian military industrial complex, the Civil and Military Aircraft Industry. to give the reader a better understanding of how the industry takes the leap from a state-owned, domestically-oriented manufacturing to a transformed and slimmed production under harsh market-oriented circumstances, a historical perspective is provided. Dr Kogan then examines the status and plans for the most important actors, the MIG MAPO, Suchoi, the Financial Industrial Group RAC and the Transnational FIG Ilyshion. The helicopter design bureau Mil is also included due to its importance domestically as well as in exports. The author scrutinizes the cooperation within CIS and with foreign firms,

especially French ones. Because of the its importance to transport aircraft production in CIS, the Ukrainian Antonov complex is also focused on.
NTIS
*Aircraft Industry; Civil Aviation; Aircraft Production*

19990008188 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
**Analytical Predictions of Fatigue Crack Growth in the Lower Plate of the F-111 Wing Pivot Fitting Fuel Flow Hole Number 58**
Murtagh, B. J., Defence Science and Technology Organisation, Australia; Walker, K. F., Defence Science and Technology Organisation, Australia; Feb. 1998; 16p; In English
Report No.(s): DSTO-TN-0135; DODA-AR-010-459; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

This report details a comparison of fatigue growth predictions for a fatigue crack in the lower plate of the F-111 Wing Pivot Fitting, adjacent to Fuel Flow Hole No 58. This is a known fatigue critical location and is designated as DI 86. Fatigue analysis using conventional fracture mechanics techniques and empirical retardation models performed by the manufacturer, Lockheed Martin Tactical Aircraft Systems (then General Dynamics), predicted a fatigue life of approximately 57,000 flight hours. An equivalent analysis was conducted using the analytical crack closure code, FASTRAN II, and this resulted in a life prediction of about 25,000 flight hours. Spectrum differences provide a partial explanation. A FASTRAN II analysis using a spectrum based on an in-flight strain measurement system known as AFDAS produced a shorter life again. Further work is underway to quantify the difference in the predictions due to spectrum differences, and that due to analysis techniques.
Author
*Crack Propagation; Strain Measurement; F-111 Aircraft; Fracture Mechanics; Crack Closure*

## 06
## AIRCRAFT INSTRUMENTATION

*Includes cockpit and cabin display devices; and flight instruments.*

19990004346 NASA Goddard Space Flight Center, Greenbelt, MD USA
**MIDEX Advanced Modular and Distributed Spacecraft Avionics Architecture**
Ruffa, John A., NASA Goddard Space Flight Center, USA; Castell, Karen, NASA Goddard Space Flight Center, USA; Flatley, Thomas, NASA Goddard Space Flight Center, USA; Lin, Michael, NASA Goddard Space Flight Center, USA; 1998; 11p; In English; Aerospace Conference, 21-28 Mar. 1998, Snowmass, CO, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

MIDEX (Medium Class Explorer) is the newest line in NASA's Explorer spacecraft development program. As part of the MIDEX charter, the MIDEX spacecraft development team has developed a new modular, distributed, and scaleable spacecraft architecture that pioneers new spaceflight technologies and implementation approaches, all designed to reduce overall spacecraft cost while increasing overall functional capability. This resultant "plug and play" system dramatically decreases the complexity and duration of spacecraft integration and test, providing a basic framework that supports spacecraft modularity and scalability for missions of varying size and complexity. Together, these subsystems form a modular, flexible avionics suite that can be modified and expanded to support low-end and very high-end mission requirements with a minimum of redesign, as well as allowing a smooth, continuous infusion of new technologies as they are developed without redesigning the system. This overall approach has the net benefit of allowing a greater portion of the overall mission budget to be allocated to mission science instead of a spacecraft bus. The MIDEX scaleable architecture is currently being manufactured and tested for use on the Microwave Anisotropy Probe (MAP), an inhouse program at GSFC.
Author
*Avionics; Spacecraft Design; Mission Planning; Anisotropy; Explorer Satellites*

19990007847 Boeing Co., Anaheim, CA USA
**Sensor Alternatives for Future Unmanned Tactical Aircraft**
Fleeman, E. L., Boeing Co., USA; Jul. 1998; 16p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper addresses the enabling technologies of the sensor suite for the next generation Unmanned Tactical Aircraft (UTA). An assessment is made of target sensors, communication sensors, and navigation sensors that are used in the UTA intelligence,

surveillance, reconnaissance, communication, and target designation missions. Emphasis is given to the classes of UTAs that operate at stand-off altitudes and ranges outside the effectiveness envelope of typical threat air defenses and jammers. Primary environmental factors that are addressed in the paper are world-wide cloud cover and rain rate. The effects of cloud cover and rain rate on sensor performance are evaluated for synthetic aperture radar (SAR), passive millimeter wave (mmW), and electro-optical (EO) sensors. The synergy of radar frequency (RF) sensors to improve the sensor suite performance in cloud cover and rain rate is addressed. The paper also addresses the enabling technologies that are required for real time, low false alarm rate (FAR), automatic target recognition (ATR) and precision targeting. A target sensor suite is postulated that is based on multi-spectral, multi-dimension discriminants of the target. An X-band or Ku-band SAR is considered to be the best overall target sensor for UTA applications. A priority ranking of other target sensors is ultra wide band (UWB) low frequency SAR, forward looking infrared (FLIR), laser infrared detection and ranging (LIDAR), visible, and passive mmW. The Year 2007 sensor suite would cover the multi-spectral range of VHF frequency to visible wavelength and the multi-dimensional parameters of contrast, two-dimensional shape, three-dimensional shape, temporal, and polarization signatures of the target.
Author
*Pilotless Aircraft; Sensors; Target Acquisition; Target Recognition; Synthetic Aperture Radar; Radar Targets; Real Time Operation*

## 07
## AIRCRAFT PROPULSION AND POWER

*Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.*

19990008190 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
**Resonance Testing of the Gnome Combustor Liner**
Dunlop, James, Defence Science and Technology Organisation, Australia; Jun. 1997; 31p; In English
Report No.(s): DSTO-TN-0093; DODA-AR-010-266; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

This report details the results of a series of experimental tests conducted on a combustor liner of the Rolls-Royce Gnome engine. These tests were undertaken as part of an investigation into the cause of cracking of the combustor liner's splitter vane. A modal analysis of the splitter vane was undertaken and mode shape results are presented over a wide range of natural frequencies. A comparison of strains generated by these modes in the areas of cracking shows that two modes in particular are a possible cause of the cracking. The effects on the splitter vane, of an interference fit between it and the engine rear frame splitter ring, are also quantified both statically and dynamically.
Author
*Linings; Resonant Frequencies; Gas Turbine Engines; Vibration Mode*

## 08
## AIRCRAFT STABILITY AND CONTROL

*Includes aircraft handling qualities; piloting; flight controls; and autopilots.*

19990004130 NASA Langley Research Center, Hampton, VA USA
**BACT Simulation User Guide (Version 7.0)**
Waszak, Martin R., NASA Langley Research Center, USA; Nov. 1997; 20p; In English
Contract(s)/Grant(s): RTOP 522-33-11-01
Report No.(s): NASA/TM-97-206252; L-17678; NAS 1.15:206252; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report documents the structure and operation of a simulation model of the Benchmark Active Control Technology (BACT) Wind-Tunnel Model. The BACT system was designed, built, and tested at NASA Langley Research Center as part of the Benchmark Models Program and was developed to perform wind-tunnel experiments to obtain benchmark quality data to validate computational fluid dynamics and computational aeroelasticity codes, to verify the accuracy of current aeroservoelasticity

design and analysis tools, and to provide an active controls testbed for evaluating new and innovative control algorithms for flutter suppression and gust load alleviation. The BACT system has been especially valuable as a control system testbed.
Author
*Active Control; Wind Tunnel Models; Test Stands; User Manuals (Computer Programs)*

19990007852 Alenia Difesa, Avionic Systems and Equipment Div., Turin, Italy
**Autopilot Synthesis for Unmanned Tactical Air Vehicles (UTAV)**
Faggion, P., Alenia Difesa, Italy; Zolla, L., Alenia Difesa, Italy; Jul. 1998; 8p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper presents an overview on the AutoPilot design philosophy for a medium class, jet powered Unmanned Tactical Air Vehicle (U.T.A.V,) and the development of its Rig + Advanced Integrated Data Acquisition & Simulation System (Rig + AIDASS). After a short description of the Mirach 150 U.T.A.V. system, the synthesis methodology of the primary control laws for the steering and navigational modes are presented (Autopilot and Flight Management System). The process aims at verifying accordance between requirements and performances of the global system (Autopilot+Airframe). The performances of the system are shown: dynamic responses in front of altitude, groundspeed and heading demands and their maintenance in presence of atmospheric turbulence (MIL-F-8785/C). The study is developed in FORTRAN 77 language.
Author
*Flight Management Systems; Automatic Pilots; Pilotless Aircraft; Data Acquisition; Control Theory; Air Navigation; Systems Integration*

19990007854 Bombardier, Inc., Defence Systems Div., Mirabel, Quebec Canada
**Autonomous Navigation and Control Functions of the CL-327 VTOL UAV**
Pelletier, M., Bombardier, Inc., Canada; Sakamoto, A., Bombardier, Inc., Canada; Tessier, C., Bombardier, Inc., Canada; Saintonge, G., Bombardier, Inc., Canada; Jul. 1998; 10p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The CL-327 vertical take-off and landing (VTOL) unmanned air vehicle has a payload carrying capability of 100 kg and an on-station endurance of 4.75 hours at 100 km (based on 50 kg payload). Although similar to that of the CL-227, the pitch, roll, yaw and height autopilots have been modified and improved to account for the capabilities and dynamics of the CL-327. The advanced guidance, navigation and control functions include GPS/DGPS-aided flight, waypoint guidance, automatic (vertical) take-off and landing as well as autonomous flight without the intervention from the surface element. Because of these and other advanced features, the CL-327 is the world's most advanced VTOL UAV in production today.
Author
*Vertical Takeoff Aircraft; Pilotless Aircraft; Autonomous Navigation; Aircraft Control; Automatic Flight Control; Design Analysis; Aircraft Design*

19990008008 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
**Maneuver Controller Design for an F-111C Flight Dynamics Model**
Gibbens, Peter W., Defence Science and Technology Organisation, Australia; May 1998; 128p; In English
Report No.(s): DSTO-RR-0129; DODA-AR-010-504; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Australia), Hardcopy, Microfiche

A maneuver controller program has been developed to fly an F-111C dynamic flight model through any number of prescribed maneuvers. A selection of discrete maneuvers is available which can be used as building blocks to represent most of those likely to be encountered in flight. Generalised maneuvers can also be flown by providing reference flight trajectories generated by an external source. The dynamic model and maneuver controller have been developed to allow the realistic modelling of maneuvers required by mission analyses, weapons delivery studies and systems assessments.
Author
*Dynamic Models; Controllers; Design; Aerodynamics*

19990008135 Research Inst. of National Defence, Dept. of Command and Control Warfare Technology, Linkoeping, Sweden
**Control Stick Steered Aircraft Simulation Model** ***Styrspaksstyrd Flygplanssimuleringsmodell***
Wissman, H., Research Inst. of National Defence, Sweden; Apr. 1998; 64p; In Swedish; Original contains color illustrations
Report No.(s): PB99-102394; FOA-R-98-00760-616-SE; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

When 'the duel between missile and aircraft' is evaluated, it is important to be able to describe and study the influence of different technical/tactical counter measures that a pilot can perform in order to decrease the probability of being shot down. This paper, a master thesis at LiTH, outlines one approach that can be used to model an aircraft, in order to describe realistic, interactive maneuvers from a control stick (joystick) connected to the computer, that is controlling the movements of the flying aircraft. The paper describes an implemented simulation model of an aircraft that is controlled by an ordinary, commercial control stick (joystick). A graphical interface, developed earlier, is used to display data and show views of the aircraft and its environment. Further, the paper also includes a description of the applied flight dynamics.
NTIS
*Control Sticks; Aircraft Models; Aerodynamics; Flight Simulation; Flight Control*

19990008184 NASA Langley Research Center, Hampton, VA USA
**High-Alpha Research Vehicle Lateral-Directional Control Law Description, Analyses, and Simulation Results**
Davidson, John B., NASA Langley Research Center, USA; Murphy, Patrick C., NASA Langley Research Center, USA; Lallman, Frederick J., NASA Langley Research Center, USA; Hoffler, Keith D., Vigyan Research Associates, Inc., USA; Bacon, Barton J., NASA Langley Research Center, USA; Oct. 1998; 70p; In English
Contract(s)/Grant(s): RTOP 522-21-61-01
Report No.(s): NASA/TP-1998-208465; NAS 1.60:208465; L-17673; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report contains a description of a lateral-directional control law designed for the NASA High-Alpha Research Vehicle (HARV). The HARV is a F/A-18 aircraft modified to include a research flight computer, spin chute, and thrust-vectoring in the pitch and yaw axes. Two separate design tools, CRAFT and Pseudo Controls, were integrated to synthesize the lateral-directional control law. This report contains a description of the lateral-directional control law, analyses, and nonlinear simulation (batch and piloted) results. Linear analysis results include closed-loop eigenvalues, stability margins, robustness to changes in various plant parameters, and servo-elastic frequency responses. Step time responses from nonlinear batch simulation are presented and compared to design guidelines. Piloted simulation task scenarios, task guidelines, and pilot subjective ratings for the various maneuvers are discussed. Linear analysis shows that the control law meets the stability margin guidelines and is robust to stability and control parameter changes. Nonlinear batch simulation analysis shows the control law exhibits good performance and meets most of the design guidelines over the entire range of angle-of-attack. This control law (designated NASA-1A) was flight tested during the Summer of 1994 at NASA Dryden Flight Research Center.
Author
*Angle of Attack; Control Theory; Directional Control; Feedback Control; Flight Control; Lateral Control; Research Vehicles; Servomechanisms; Thrust Vector Control; F-18 Aircraft*

## 09
## RESEARCH AND SUPPORT FACILITIES (AIR)

*Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.*

19990004169 Applied Research Associates, Inc., Vicksburg, MS USA
**Preliminary Analytical Model for Flexible Pavement** ***Final Report***
Bryant, Larry M., Applied Research Associates, Inc., USA; Jul. 1998; 65p; In English
Contract(s)/Grant(s): DNA001-93-C-0147
Report No.(s): AD-A352986; WES/CR/GL-98-4; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report documents the first step in development of a preliminary analytical model for flexible pavement analysis for the Airfields and Pavements Division (APD), Geotechnical Laboratory, US Army Engineer Waterways Experiment Station. This first step may be generally described as development of a linear elastic finite element model that reasonably compares with the empirical and/or layered elastic solutions in current use. This report does not attempt to document a literature survey related to pavement analysis nor does it discuss the background of previous pavement analysis methods or finite element methods beyond that necessary for understanding of the problem at hand. Further, this study attempts to determine the optional usage of the specific tools at hand, i.e., PATRAN (1993) and ABAQUS (1992), in development of the improved analytical model. It does not attempt to gen-

eralize to other finite element modeling tools or the broad finite element method. This report includes and builds upon previous work done by the author in this area.
DTIC
*Pavements; Computer Programs; Geotechnical Engineering*

19990005999 National Inst. of Standards and Technology, Process Measurements Div., Gaithersburg, MD USA
**NIST Measurement Services: NIST Calibration Services for Gas Flow Meters. Piston Prover and Bell Prover Gas Flow Facilities**
Wright, J. D., National Inst. of Standards and Technology, USA; Mattingly, G. E., National Inst. of Standards and Technology, USA; Aug. 1998; 54p; In English
Report No.(s): PB99-107260; NIST/SP-250-49; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This document provides a description of the small and medium range gas flow calibration facilities at the National Institute of Standards and Technology (NIST) Fluid Flow Group, as reported in NIST Special Publication 250 for Test Nos. 18010C-18040C and 18050S, Flow Rate Measurements. The Fluid Flow Group can perform gas meter calibrations and special tests at flows between 3.7 x 10(exp -5) cu m/min and 1.4 m(3)/min (0.001 standard cubic feet per minute (SCFM) and 51 scfm, reference temperature and pressure are 293.15 K and 101325 Pa) using positive displacement techniques. The flow rate of gas passing through the meter under test is determined from pressure, temperature, volume, and transit time measurements of a displaced volume of gas. Two types of displacement devices are used mercury-sealed piston provers and bell gasometers, or bell provers. This report describes the techniques used for calibrating meters and presents the uncertainty analysis associated with such calibrations.
NTIS
*Calibrating; Services; Gas Flow; Gas Meters; Flowmeters*

19990007757 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
**Performance Tests of the Original Transonic Wind Tunnel Compressor and Circuit**
Link, Yoel Y., Defence Science and Technology Organisation, Australia; Quick, Howard A., Defence Science and Technology Organisation, Australia; May 1998; 84p; In English; Original contains color illustrations
Report No.(s): DSTO-TN-0150; DODA-AR-010-527; Copyright; Avail: Issuing Activity (DSTO, Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Australia), Hardcopy, Microfiche

A detailed test programme of the AMRL Transonic Wind Tunnel was conducted. The objective of the test programme was to determine the pressure distributions around the tunnel circuit with larger nozzle exit areas. The existing high speed contraction, test section, model support mechanism, and downstream diffuser were removed for the tests. A variable nozzle and collector were designed and installed in place of the removed components to determine the effects of increasing the nozzle exit area. Three nozzle configurations were investigated, with a 38.3%, 44.4% and 58.1% increase in area relative to the existing test section area. Measurements were made of static pressure around the tunnel circuit, total pressure upstream and downstream from the compressor, and temperatures at various locations. Noise measurements were also made outside the tunnel complex and at four locations around the boundary of the site to determine the noise level of the wind tunnel.
Author
*Performance Tests; Transonic Wind Tunnels; Compressors; Circuits; Pressure Distribution*

## 10
## ASTRONAUTICS

*Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.*

19990004144 Stanford Univ., Dept. of Aeronautics and Astronautics, Stanford, CA USA
**Simulation-Based Analysis of Reentry Dynamics for the Sharp Atmospheric Entry Vehicle** *Final Report, Jan. 1997 - May 1998*
Tillier, Clemens Emmanuel, Stanford Univ., USA; May 1998; 120p; In English
Contract(s)/Grant(s): NCC2-5197
Report No.(s): NASA/CR-1998-208334; NAS 1.26:208334; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This thesis describes the analysis of the reentry dynamics of a high-performance lifting atmospheric entry vehicle through numerical simulation tools. The vehicle, named SHARP, is currently being developed by the Thermal Protection Materials and Systems branch of NASA Ames Research Center, Moffett Field, California. The goal of this project is to provide insight into trajectory tradeoffs and vehicle dynamics using simulation tools that are powerful, flexible, user-friendly and inexpensive. Implemented Using MATLAB and SIMULINK, these tools are developed with an eye towards further use in the conceptual design of the SHARP vehicle's trajectory and flight control systems. A trajectory simulator is used to quantify the entry capabilities of the vehicle subject to various operational constraints. Using an aerodynamic database computed by NASA and a model of the earth, the simulator generates the vehicle trajectory in three-dimensional space based on aerodynamic angle inputs. Requirements for entry along the SHARP aerothermal performance constraint are evaluated for different control strategies. Effect of vehicle mass on entry parameters is investigated, and the cross range capability of the vehicle is evaluated. Trajectory results are presented and interpreted. A six degree of freedom simulator builds on the trajectory simulator and provides attitude simulation for future entry controls development. A Newtonian aerodynamic model including control surfaces and a mass model are developed. A visualization tool for interpreting simulation results is described. Control surfaces are roughly sized. A simple controller is developed to fly the vehicle along its aerothermal performance constraint using aerodynamic flaps for control. This end-to-end demonstration proves the suitability of the 6-DOF simulator for future flight control system development. Finally, issues surrounding real-time simulation with hardware in the loop are discussed.
Author
*Aerodynamic Characteristics; Computerized Simulation; Lifting Bodies; Trajectory Control; Atmospheric Entry; Thermal Protection; Flight Control*

19990007761 Boeing North American, Inc., Reusable Space Systems, Downey, CA USA
**Propulsion system advances that enable a reusable Liquid Fly Back Booster (LFBB)**
Keith, E. L., Boeing North American, Inc., USA; Rothschild, W. J., Boeing North American, Inc., USA; 1998; 8p; In English, 16-17 Jul. 1998, Cleveland, OH, USA; Sponsored by NASA, USA
Contract(s)/Grant(s): NAS8-97272; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper provides an overview of the booster propulsion system for the Liquid Fly Back Booster (LFBB). This includes, system requirements, design approach, concept of operations, reliability, safety and cost assumptions. The paper summarizes the findings of the Boeing propulsion team that has been studying the LFBB feasibility as a booster replacement for the Space Shuttle. This paper will discuss recent advances including a new generation of kerosene and oxygen rich pre-burner staged combustion cycle main rocket engines. The engine reliability and safety is expected to be much higher than current standards by adding extra operating margins into the design and normally operating the engines at 75% of engine rated power. This allows for engine out capability. The new generation of main engines operates at significantly higher chamber pressure than the prior generation of gas generator cycle engines. The oxygen rich pre-burner engine cycle, unlike the fuel rich gas generator cycle, results in internally self-cleaning firings which facilitates reusability. Maintenance is further enhanced with integrated health monitoring to improve safety and turn-around efficiency. The maintainability of the LFBB LOX/kerosene engines is being improved by designing the vehicle/engine interfaces for easy access to key engine components.
Author
*Rocket Engines; Propulsion; Liquid Oxygen; Engine Parts; Reusable Rocket Engines; Reusable Launch Vehicles; Post Boost Propulsion System; Aerodynamic Characteristics; Aerospace Engineering*

19990008131 Stockholm Univ., Meteorology Dept., Sweden
**Aerodynamics of Rocket-Borne In situ Measurements in the Transition Regime**
Gumbel, J., Stockholm Univ., Sweden; Dec. 04, 1997; ISSN 0280-4441; 70p; In English
Report No.(s): PB99-100786; REPT-AP-33; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A quantification of aerodynamic perturbations is crucial to the analysis of rocket-borne in situ measurements in the middle and upper atmosphere. In the important altitude range 80-120 km, this quantification is complicated by the gradual shift of the flow conditions from continuum flow via the transition regime to free molecular flow. The 'Direct Simulation Monte Carlo' method by G. A. Bird provides a tool to access the aerodynamics in this region by tracing the behavior of the gas on a molecular basis. After a brief presentation of the underlying gas kinetics and the simulation algorithms, the model is applied to a number of questions relevant for in situ composition measurements. For representative payload geometries, density, temperature and velocity fields are investigated as a function of altitude and flow speed. In addition, studies of individual molecular trajectories

help to clarify details of the payload/gas interactions. Strongly altitude-dependent flow conditions are found in the range 85-105 km.
NTIS
*Aerodynamics; Rocket-Borne Instruments; Aerodynamic Forces; Flow Distribution; In Situ Measurement*

## 11
## CHEMISTRY AND MATERIALS

*Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.*

19990004100 California Univ., Dept. of Mechanical and Environmental Engineering, Santa Barbara, CA USA
**Structural Qualification of Composite Airframes**
Kedward, Keith T., California Univ., USA; McCarty, John E., California Univ., USA; 1997; 81p; In English
Contract(s)/Grant(s): NAG1-1376; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The development of fundamental approaches for predicting failure and elongation characteristics of fibrous composites are summarized in this document. The research described includes a statistical formulation for individual fiber breakage and fragmentation and clustered fiber breakage, termed macrodefects wherein the aligned composite may represent a structural component such as a reinforcing bar element, a rebar. Experimental work conducted in support of the future exploitation of aligned composite rebar elements is also described. This work discusses the experimental challenges associated with rebar tensile test evaluation and describes initial numerical analyses performed in support of the experimental program.
Author
*Composite Structures; Airframe Materials; Tensile Tests; Fiber Composites*

19990004341 Clark-Atlanta Univ., GA USA
**Constitutive Modeling and Testing of Polymer Matrix Composites Incorporating Physical Aging at Elevated Temperatures, *1 Jun. 1995 - 31 May 1998***
Veazie, David R., Clark-Atlanta Univ., USA; 1998; 17p; In English
Contract(s)/Grant(s): NAG1-1727; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Advanced polymer matrix composites (PMC's) are desirable for structural materials in diverse applications such as aircraft, civil infrastructure and biomedical implants because of their improved strength-to-weight and stiffness-to-weight ratios. For example, the next generation military and commercial aircraft requires applications for high strength, low weight structural components subjected to elevated temperatures. A possible disadvantage of polymer-based composites is that the physical and mechanical properties of the matrix often change significantly over time due to the exposure of elevated temperatures and environmental factors. For design, long term exposure (i.e. aging) of PMC's must be accounted for through constitutive models in order to accurately assess the effects of aging on performance, crack initiation and remaining life. One particular aspect of this aging process, physical aging, is considered in this research.
Author
*Structural Design; Polymer Matrix Composites; Mechanical Properties; High Strength; Crack Initiation; Composite Structures; Composite Materials; Commercial Aircraft; Aging (Materials)*

19990008262 Federal Aviation Administration, William J. Hughes Technical Center, Atlantic City, NJ USA
**A Review of the Flammability Hazard of Jet A Fuel Vapor in Civil Transport Aircraft Fuel Tanks *Final Report***
Jun. 1998; 68p; In English
Report No.(s): PB99-102675; DOT/FAA/AR-98/26; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This reporting documents the findings of a Fuel Flammability Task Group made up of recognized fuel and combustion specialists investigating the flammability and explosiveness of fuel within an aircraft fuel tank. The task group reviewed all available reports on the subject and met and discussed the data with technical experts from Boeing Commercial Airplane Co., California Institute of Technology, and the National Transportation Safety Board. The scope of the report includes jet fuel definitions and specifications, jet fuel flammability data, influences of various factors on fuel flammability, and predictive analyses and models for flammability. The report discusses the impact of this knowledge on the needs for in-flight fuel fire prevention.
NTIS
*Flammability; Hazards; Jet Engine Fuels; Vapors; Transport Aircraft; Fuel Tanks; Aircraft Fuels; Fuel Combustion; Civil Aviation*

## 12
## ENGINEERING

*Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.*

19990007857 Marconi S.p.A., Defence Div., Genoa, Italy

**Integrated Data Link for UTA Applications: Design Considerations and Development Results**

Bianchi, L., Marconi S.p.A., Italy; Battaini, G., Marconi S.p.A., Italy; Scazzola, G. L., Marconi S.p.A., Italy; Crovari, E., Marconi S.p.A., Italy; Jul. 1998; 16p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The UTA (Unmanned Tactical Aircraft) or, in general, the UAV (Unmanned Air Vehicle) typical requirements for either non-lethal or lethal tactical missions, imply both the capability to transmit, by means of a Data Link, real-time data (for instance IR, Video, Radar or Navigation Data) and to receive commands (to reprogram partially or completely the mission profile) to/from Ground Stations. The paper faces various aspects related to Data Links for UTA/UAV, presents system considerations and describes the development results obtained with the J Band UAV Data Link realized in Marconi and provided to Italian MoD. Author

*Data Links; Real Time Operation; Ground Stations; Pilotless Aircraft; Superhigh Frequencies*

19990007863 Wright Lab., Armament Directorate, Eglin AFB, FL USA

**Small Effective Air-to-Surface Munitions for Unmanned Tactical Aircraft Applications**

Brubaker, D. R., Wright Lab., USA; Jul. 1998; 12p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes two emerging munition technologies beneficial to Unmanned Tactical Aircraft (UTA) and attempts to define a necessary weapon load capability. to determine a weapon/loadout combination that maximized the lethal effectiveness of an UTA while minimizing the payload weight required, a mission level analysis was conducted and concludes that a minimum of 1000-lb (454 kg) of payload provides an UTA a viable air-to-ground combat mission capability. A 2000-lb (908 kg) payload provides an increased effectiveness but must be contrasted with the associated increase in UTA cost, size, weight and propulsion needed to employ the additional payload weight.

Author

*Pilotless Aircraft; Weapons Delivery; Payload Integration; Air to Surface Missiles; Combat*

19990004124 NASA Goddard Space Flight Center, Greenbelt, MD USA

**Design and Flight Performance of NOAA-K Spacecraft Batteries**

Rao, Gopalakrishna M., NASA Goddard Space Flight Center, USA; Chetty, P. R. K., Krispin Technologies, Inc., USA; Spitzer, Tom, NASA Goddard Space Flight Center, USA; Chilelli, P., Lockheed Martin Missiles and Space, USA; 1998; 28p; In English; Aerospace Battery Workshop, 27-29 Oct. 1998, Huntsville, AL, USA; Sponsored by NASA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The US National Oceanic and Atmospheric Administration (NOAA) operates the Polar Operational Environmental Satellite (POES) spacecraft (among others) to support weather forecasting, severe storm tracking, and meteorological research by the National Weather Service (NWS). The latest in the POES series of spacecraft, named as NOAA-KLMNN', one is in orbit and four more are in various phases of development. The NOAA-K spacecraft was launched on May 13, 1998. Each of these spacecraft carry three Nickel-Cadmium batteries designed and manufactured by Lockheed Martin. The battery, which consists of seventeen 40 Ah cells manufactured by SAFT, provides the spacecraft power during the ascent phase, orbital eclipse and when the power demand is in excess of the solar array capability. The NOAA-K satellite is in a 98 degree inclination, 7:30AM ascending node orbit. In this orbit the satellite experiences earth occultation only 25% of the year. This paper provides a brief overview of the power subsystem, followed by the battery design and qualification, the cell life cycle test data, and the performance during launch and in orbit.

Author

*Electric Batteries; Life (Durability); Nickel Cadmium Batteries; Flight Characteristics; Ascent; Launching*

19990004073 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
**Computational Fluid Dynamics Modeling of Multi-body Missile Aerodynamic Interference** *Final Report*
Sahu, Jubaraj, Army Research Lab., USA; Edge, Harris L., Army Research Lab., USA; Heavey, Karen R., Army Research Lab., USA; Ferry, Earl N., Army Research Lab., USA; Aug. 1998; 37p; In English
Contract(s)/Grant(s): Proj-1L162618AH80
Report No.(s): AD-A354107; ARL-TR-1765; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Computational fluid dynamics (CFD) calculations have been performed for a multi-body system consisting of a main missile and a number of submunitions. Numerical flow field computations have been made for various orientations and locations of submunitions using an unsteady, zonal Navier-Stokes code and the chimera composite grid discretization technique at transonic speeds and zero degree angle of attack. Both steady state and unsteady numerical results have been obtained and compared for two submunitions and a missile system. Computed results show the details of the expected flow field features, including the shock interactions. Computed results are compared with limited experimental data obtained for the same configuration and conditions and are generally found to be in good agreement with the data. Comparison of the unsteady and steady state results shows an appreciable change in the aerodynamic forces and moments.
DTIC
*Computational Fluid Dynamics; Aerodynamic Forces; Mathematical Models; Computational Grids; Position (Location); Grid Generation (Mathematics); Flow Distribution*

19990004404 Ben Gurion Univ. of the Negev, Beersheva, Israel
**The 13th International Mach Reflection Symposium: Scientific Program and Book of Abstracts**
Ben-Dor, Gabi, Editor; Jul. 03, 1998; 85p; In English; 13th; Mach Reflection, 28 Jun. - 3 Jul. 1998, Beer Sheva, Israel
Report No.(s): AD-A354149; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche; Abstracts Only; Abstracts Only

The report is a book of abstracts which documents information presented at the 13th International symposium on Mach Reflection. The conference held from 28 June to 03 Jul 98 in Ben-Gurion University of the Negev, Beer Sheva, Israel. The purpose of the scientific program provided a professional forum for a broad exchange of information and ideas on Shock Wave reflection and computational fluid dynamics for aerospace applications.
DTIC
*Shock Waves; Computational Fluid Dynamics; Aerodynamics; Mach Reflection*

19990008011 NASA Ames Research Center, Moffett Field, CA USA
**Full-Scale Wind Tunnel Test of the Aeroelastic Stability of a Bearingless Main Rotor**
Warmbrodt, William, NASA Ames Research Center, USA; McCloud, John L., III, NASA Ames Research Center, USA; Sheffler, Marc, Boeing Vertol Co., USA; Staley, James, Boeing Vertol Co., USA; Vertica; 1982; ISSN 0360-5450; Volume 6, pp. 165-180; In English; 37th, 17-20 May 1981, New Orleans, LA, USA; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A full-scale wind tunnel test of a helicopter bearingless main rotor was conducted in the NASA- Ames 40- by 80-ft Wind Tunnel. The primary objective of the test A as to thoroughly investigate the aeroelastic stability characteristics of this advanced technology rotor in a controlled wind tunnel test environment. Rotor stability was determined in hover and at speeds up to 143 kt as a function of lift, tip speed, and shaft angle. The rotor was stable for all conditions tested. No significant decreases in stability due to support mode coalescence with the rotor inplane regressing mode were observed. Stability levels increased with increasing collective at constant tip speed and shaft angle. At constant lift, tip speed and shaft angle, the rotor stability increased between 60 and 90 kt. decreased at 120 kt, and significantly increased again at 143 kt. At constant shaft angle, tip speed, and pitch setting, the rotor loses damping with increasing airspeed above 60 kt. Reduction in the control system stiffness reduced the stability level in hover at 400 rpm but had little effect at other tip speeds. Correlation with existing stability test data is shown. Stability testing in the wind tunnel yielded similar damping trends to those obtained from whirl tower and flight tests. Comparison of wind tunnel data with calculated stability results shows that although the analysis correctly predicts stability trends with tip speed and pitch setting. the predicted damping values are generally too large. The analysis does not predict the decrease in rotor stability with airspeed at constant shaft angle, tip speed, and pitch setting as determined from the wind tunnel test.
Author
*Wind Tunnel Tests; Full Scale Tests; Aeroelasticity; Stability Tests; Bearingless Rotors*

19990004110 Wayne State Univ., Dept. of Mathematics, Detroit, MI USA
**Active Control of Panel Vibrations Induced by a Boundary Layer Flow** *Final Report, 10 Aug. 1990 - 30 Jun. 1998*
Chow, Pao-Liu, Wayne State Univ., USA; Oct. 22, 1998; 18p; In English
Contract(s)/Grant(s): NAG1-1175; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In recent years, active and passive control of sound and vibration in aeroelastic structures have received a great deal of attention due to many potential applications to aerospace and other industries. There exists a great deal of research work done in this area. Recent advances in the control of sound and vibration can be found in the several conference proceedings. In this report we will summarize our research findings supported by the NASA grant NAG-1-1175. The problems of active and passive control of sound and vibration has been investigated by many researchers for a number of years. However, few of the articles are concerned with the sound and vibration with flow-structure interaction. Experimental and numerical studies on the coupling between panel vibration and acoustic radiation due to flow excitation have been done by Maestrello and his associates at NASA/Langley Research Center. Since the coupled system of nonlinear partial differential equations is formidable, an analytical solution to the full problem seems impossible. For this reason, we have to simplify the problem to that of the nonlinear panel vibration induced by a uniform flow or a boundary-layer flow with a given wall pressure distribution. Based on this simplified model, we have been able to study the control and stabilization of the nonlinear panel vibration, which have not been treated satisfactorily by other authors. The vibration suppression will clearly reduce the sound radiation power from the panel. The major research findings will be presented in the next three sections. In Section II we shall describe our results on the boundary control of nonlinear panel vibration, with or without flow excitation. Section III is concerned with active control of the vibration and sound radiation from a nonlinear elastic panel. A detailed description of our work on the parametric vibrational control of nonlinear elastic panel will be presented in Section IV. This paper will be submitted to the Journal of Acoustic Society of America for publication.
Derived from text

*Boundary Layer Flow; Active Control; Vibration; Pressure Distribution; Aeroelasticity; Uniform Flow*

19990004187 Old Dominion Univ., Dept. of Civil and Environmental Engineering, Norfolk, VA USA

**New Parallel Algorithms for Structural Analysis and Design of Aerospace Structures** *Final Report, Period ending 30 Jun. 1998*

Nguyen, Duc T., Old Dominion Univ., USA; Oct. 1998; 88p; In English

Contract(s)/Grant(s): NAG1-858; ODURF Proj. 184047; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Subspace and Lanczos iterations have been developed, well documented, and widely accepted as efficient methods for obtaining p-lowest eigen-pair solutions of large-scale, practical engineering problems. The focus of this paper is to incorporate recent developments in vectorized sparse technologies in conjunction with Subspace and Lanczos iterative algorithms for computational enhancements. Numerical performance, in terms of accuracy and efficiency of the proposed sparse strategies for Subspace and Lanczos algorithm, is demonstrated by solving for the lowest frequencies and mode shapes of structural problems on the IBM-R6000/590 and SunSparc 20 workstations.
Author

*Algorithms; Aircraft Structures; Structural Analysis; Vibration Mode*

19990004391 New Hampshire Univ., Dept. of Mechanical Engineering, Durham, NH USA

**Stress-Intensity Factors Along Three-Dimensional Elliptical Crack Fronts** *Final Report*

Gosz, M., New Hampshire Univ., USA; Moran, B., Federal Aviation Administration, USA; May 1998; 14p; In English

Report No.(s): AD-A353955; DOT/FAA/AR-96/97; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of the present investigation is to determine the model stress-intensity factors along two symmetric surface cracks emanating from a centrally located hole in a rectangular plate (the so-called Round Robin Problem) using the domain integral method. In order to validate the present three-dimensional domain integral implementation, two comparisons were made with benchmark solutions. We first considered the problem of an elliptical crack embedded in a rectangular plate. For plate dimensions much greater than the largest characteristic dimension of the elliptical crack, we compared the present finite element results with the solution of Irwin (1962) for an elliptical crack embedded in an infinitely extended solid. Next, we considered the problem of a quarter-elliptical corner crack in a rectangular,plate and compared the results with those of Newman and Raju (1983). Excellent agreement was obtained for both benchmark comparisons.
DTIC

*Stress Intensity Factors; Three Dimensional Bodies; Fuselages; Research; Rectangular Plates; Cracks; Corners*

## 13
## GEOSCIENCES

*Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.*

19990008399 Helsinki Univ. of Technology, Lab. of Space Technology, Espoo, Finland
**Helsinki University of Technology, Laboratory of Space Technology** *Annual Report*
Hallikainen, Martti, Editor, Helsinki Univ. of Technology, Finland; May 1998; ISSN 0786-8154; 56p; In English
Report No.(s): PB99-108607; REPT-34; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche

The activities of the Laboratory of Space Technology in 1997 are described. The Laboratory is responsible for teaching space technology at the University. Two Master of Science in Technology degrees and two Licentiate in Technology degrees were awarded. The main area in research is spaceborne and airborne remote sensing, including instrumentation, measurements and development of geophysical inversion algorithms. Six projects are funded by the European Commission and European Space Agency. The further developed HUTRAD airborne microwave radiometer system is accommodated onboard the Laboratory's Skyvan research aircraft. The aircraft was operated in several research projects. The main applications were forest inventory, snow mapping, sea ice research, water quality monitoring, and atmospheric research. Martti Hallikainen served in 1997 as President of the IEEE Geoscience and Remote Sensing Society.
NTIS
*Aerospace Engineering; Research Projects; Education; Geophysics; Research Aircraft*

## 14
## LIFE SCIENCES

*Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.*

19990007887 Defence Evaluation Research Agency, Systems Integration Dept., Farnborough, UK
**Operational Rationale and Related Issues for Alternative Control Technologies**
Rood, G. M., Defence Evaluation Research Agency, UK; Alternative Control Technologies: Human Factors Issues; Oct. 1998; 8p; In English; Also announced as 19990007886; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The demanding operations in the current generations of fixed and rotary wing aircraft, particularly at night and in poor weather, have increased the need for more 'eyes-out' operations, which decreases the time for 'head down' or 'head in' viewing time, both for switching operations and for assimilation of information from head down displays. Similarly the speed of operations has led to less time being available for these two operations. Progress has been made towards the assimilation of visual display data through the move towards Helmet Mounted Displays and the time reductions in switching have been achieved through ensuring that the pilot has no need to move his hands from the primary aircraft controls during high workload periods by the use of the Hands On Throttle And Stick (HOTAS) concept. Using Fitts Law, namely that the time to move the hand to a target (in this case a switch or button) depends only upon the relative precision required, indicates that the movement time - a summed combination of perceptual processing, cognitive processing and motor processing - is in the region of 250 ms (an aircraft moving at 500 knots travels in the region of 80 metres in this time). Thus a time saving of around 250 msec is achievable by minimising the hand movements. This generally involves the provision of all of the necessary manual switches on either the throttle top or the control column (stick) top, (HOTAS) or Hands On Collective and Cyclic (HOCAC) - for helicopters - during all critical flight operations.
Derived from text
*Aircraft Control; Helmet Mounted Displays; Workloads (Psychophysiology); Flight Operations; Control Systems Design; Human Factors Engineering*

19990007892 Applied Science Labs., Bedford, MA USA
**Technology and Application of Head Based Control**
Borah, Joshua, Applied Science Labs., USA; Oct. 1998; 12p; In English; Also announced as 19990007886; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

This lecture reviews the use of head position and orientation as a means for human interaction with computers and other systems, especially in the military aerospace environment. It addresses the reasons for using head based control, current measurement technology, relevant physiological and behavioral factors, and the uses of head based control to date.
Author
*Aircraft Control; Control Equipment; Control Systems Design; Automatic Control; Head Movement; Human-Computer Interface*

19990007894 Defence Evaluation Research Agency, Systems Integration Dept., Farnborough, UK
**Human Factors Issues for the Integration of Alternative Control Technologies**
Rood, G. M., Defence Evaluation Research Agency, UK; Oct. 1998; 8p; In English; Also announced as 19990007886; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The introduction of Alternative Control Technologies (ACTs), and their closer links with human natural behaviour, will require a better balance between the human factors requirements and the aircraft integration engineering issues. Successful integration of ACTs into aircraft systems should provide significant operational advantages, and the following paragraphs discuss an approach for the necessary balance of human factors and engineering.
Author
*Human Factors Engineering; Aircraft Control; Control Systems Design; Human-Computer Interface; Automatic Control*

19990007895 Sextant Avionique, Saint Medard en Jalles, France
**Synthesis- and Expected Benefit Analysis**
Leger, Alain, Sextant Avionique, France; Oct. 1998; 10p; In English; Also announced as 19990007886; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

A synthetic approach of the various Alternative Control Technologies is proposed, taking into account advantages and inconveniences for military aircraft applications. Operational rationale, classification of technologies following capabilities and degree of maturity, summary of main functional characteristics and integration issues are critically reviewed. A brief presentation of multimodal dialog issues is also presented. Finally, a tentative investigation of potential areas of benefits for military aircraft design and operation is conducted.
Author
*Control Systems Design; Human-Computer Interface; Human Factors Engineering; Aircraft Control; Automatic Control*

## 15
## MATHEMATICAL AND COMPUTER SCIENCES

*Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.*

19990004344 Woodside Summit Group, Inc., Mountain View, CA USA
**Conversion from Engineering Units to Telemetry Counts on Dryden Flight Simulators**
Fantini, Jay A., Woodside Summit Group, Inc., USA; Oct. 1998; 14p; In English; 34th; International Telemetry Conference, 26-28 Oct. 1998, San Diego, CA, USA
Contract(s)/Grant(s): RTOP 314-02-00
Report No.(s): NASA/CR-1998-206563; NAS 1.26:206563; H-2272; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Dryden real-time flight simulators encompass the simulation of pulse code modulation (PCM) telemetry signals. This paper presents a new method whereby the calibration polynomial (from first to sixth order), representing the conversion from counts to engineering units (EU), is numerically inverted in real time. The result is less than one-count error for valid EU inputs. The Newton-Raphson method is used to numerically invert the polynomial. A reverse linear interpolation between the EU limits is used to obtain an initial value for the desired telemetry count. The method presented here is not new. What is new is how classical numerical techniques are optimized to take advantage of modem computer power to perform the desired calculations in real time. This technique makes the method simple to understand and implement. There are no interpolation tables to store in memory as in traditional methods. The NASA F-15 simulation converts and transmits over 1000 parameters at 80 times/sec. This paper presents algorithm development, FORTRAN code, and performance results.
Author
*Flight Simulators; F-15 Aircraft; Polynomials; Newton-Raphson Method; Applications Programs (Computers); FORTRAN; Pulse Code Modulation; Real Time Operation; Pcm Telemetry*

19990005099 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
**Hughes Aircraft's Widespread Deployment of a Continuously Improving Software Process** *Final Report*
Willis, R. R.; Rova, R. M.; Scott, M. D.; Johnson, M. I.; Ryskowski, J. F.; May 1998; 102p; In English
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A353168; CMU/SEI-98-TR-006; ESC*-TR-98-006; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report describes the software improvement activities of Hughes Aircraft Company over the last 25 years. The focus is on continuous improvement of the software development process and the deployment of that process from a single organization at Fullerton, California, to virtually all the 5000 software engineers of Hughes Aircraft. For this achievement, the widespread deployment of a continuously improving software process, Hughes Aircraft was awarded the 1997 IEEE Computer Society Software Process Achievement Award.
DTIC
*Hughes Aircraft; Deployment; Software Engineering; Aircraft Industry*

19990007838 Alenia Spazio S.p.A., Product Development, Turin, Italy
**From Manned to Unmanned: A Viable Alternative to the Scrapyard**
Gatti, A., Alenia Spazio S.p.A., Italy; System Design Considerations for Unmanned Tactical Aircraft (UTA); Jul. 1998; 10p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Analyzing the different scenarios currently considered by NATO (Peace keeping, Out of Area, Counter Proliferation, Article 5) requirements of weapon systems at the same time precise, lethal, with a great stand-off range and endurance capability emerge. Budget, humanitarian and political needs together with improvements in technology suggest that un-habitated systems will become the best answer to those requirements. The Italian Air Force still operate a large number of F-104s that within a few years will be phased out. The conversion of F-104s into autonomous and recoverable unmanned vehicles able to perform ground attack or SEAD missions, or into a high-altitude reconaissance platform is feasible and seems an attractive and affordable way to develop an effective hardware able to safely operate in mixed air operations in which manned and unmanned planes share different roles.
Author
*North Atlantic Treaty Organization (NATO); Pilotless Aircraft; F-104 Aircraft; Cost Effectiveness*

19990007839 Aerospatiale, Defense Systems Preliminary Design Dept., Les Mureaux, France
**The Role of Unmanned Tactical Aircraft in the Battlefield Surveillance**
Thevenot, Regis, Aerospatiale, France; dAudiffret, Antoine, Aerospatiale, France; Jul. 1998; 8p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper deals with the role of Unmanned Tactical Aircraft (UTA) in tactical surveillance and support missions on a battlefield. It addresses the main following points: (1) A definition of what are the "UTA" addressed in this paper; (2) An overview of the new battlefields and their influence in the surveillance and reconnaissance missions and architectures; (3) A presentation of the environment where the UTA have to fly - atmospheric constraints, operational constraints, enemy constraints; (4) A description of the various missions which could be performed. In particular, for reconnaissance and surveillance missions, some examples extracted from STANAG 3769 will be given and will demonstrate the ability of some classes of UTAs and sensors to perform some specific missions; and (5) An overview of some UTA proposed by Aerospatiale and some other companies with their main characteristics. This part will be focused on existing systems such as CL 289 (deployed in Bosnia), Medium Altitude vehicles and High Altitude Long Endurance concepts. The paper will end with the description of some Concepts of Operations for UTA systems on a Battlefield.
Author
*Pilotless Aircraft; Surveillance; Aerial Reconnaissance*

19990007841 Defence Evaluation Research Agency, Centre for Defence Analysis, Farnborough, UK
**The Operational Effectiveness of UCAVs in Mobile Target Attack**
Stewart, B. D., Defence Evaluation Research Agency, UK; Jul. 1998; 6p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper addresses a high-level approach to the analysis of uninhabited combat air vehicle (UCAV) effectiveness. The need for effectiveness analysis to take place in a range of realistic operational contexts is established, and the utility of effectiveness analysis is addressed. It is argued that it is necessary to take a 'system of systems' view in assessing UCAV effectiveness due to the diversity of impacts such systems will have on military operations. Relationships between some areas of UCAV performance,

and their impacts on UCAV effectiveness, are presented as examples of the complexity of UCAV operations and to demonstrate the need for effectiveness analysis to assist in system definition.
Author
*System Effectiveness; Systems Analysis; Pilotless Aircraft; Target Acquisition*

19990007843 Aerospatiale, Defense Systems Preliminary Design Dept., Les Mureaux, France
**CONOPS of HALE UTA in an Infrared Early Warning Mission for Theater Missiles Defense**
Gilibert, Herve, Aerospatiale, France; Thevenot, Regis, Aerospatiale, France; Jul. 1998; 8p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper presents the concept of High Altitude Long Endurance UTA equipped with Infrared sensors for Tactical Ballistic Missiles (TBM) detection and tracking. After a short presentation of the general context of operations in an Anti Tactical Ballistic Missile (ATBM) defense system, the IR HALE concept is depicted in its technical aspects as well as in its operational aspects: (1) analysis of potential "observable features" (signatures) of missiles, and crossing with general ATBM defense needs leading to introduce the IR HALE concept; (2) analysis of its potential performance levels in two major observation functions (missiles detection and tracking), derivation of a preliminary design; (3) exploration of major operational features (survivability,...); (4) synthesis of these elements: analysis of defense capabilities in typical TBM "Out of Area" scenery, potential roles inside global ATBM defense Systems, for Early Warning, and Weapon Systems commitment; (5) description of the command and control segment of such a system and its integration into air operations; and (6) brief overview of the other missions that can be envisioned for such a UTA. Concluding remarks highlight the position of the IR HALE UTA concept among other Early Warning / Cueing systems, both in terms of technical performance and military concept of employment.
Author
*Early Warning Systems; Missile Defense; Ballistic Missiles; Pilotless Aircraft; Missile Tracking; Infrared Tracking; Remotely Piloted Vehicles*

19990007850 NASA Dryden Flight Research Center, Edwards, CA USA
**Operational Concepts for Uninhabited Tactical Aircraft**
Deets, Dwain A., NASA Dryden Flight Research Center, USA; Purifoy, Dana, NASA Dryden Flight Research Center, USA; Jul. 1998; 4p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

This paper describes experiences with five remotely piloted flight research vehicle projects in the developmental flight test phase. These projects include the Pathfinder, Perseus B, Altus, and X-36 aircraft and the Highly Maneuverable Aircraft Technology (HiMAT). Each of these flight projects was flown at the NASA Dryden Flight Research Center. With the exception of the HIMAT, these projects are a part of the Flight Research Base Research and Technology (R&T) Program of the NASA Aeronautics and Space Transportation Technology Enterprise. Particularly with respect to operational interfaces between the ground-based pilot or operator, this paper draws from those experiences, then provides some rationale for extending the lessons learned during developmental flight research to the possible situations involved in the developmental flights proceeding deployed uninhabited tactical aircraft (UTA) operations. Two types of UTA control approaches are considered: autonomous and remotely piloted. In each of these cases, some level of human operator or pilot control blending is recommended. Additionally, "best practices" acquired over years of piloted aircraft experience are drawn from and presented as they apply to operational UTA.
Author
*Remotely Piloted Vehicles; Pilotless Aircraft; Research Vehicles; Highly Maneuverable Aircraft; Autonomous Navigation; Remote Control; Flight Control*

19990007851 Defence Evaluation Research Agency, Air Systems Sector, Farnborough, UK
**The Challenge of UAV Supporting Offensive Air Operations**
Frampton, R. A., Defence Evaluation Research Agency, UK; Jul. 1998; 6p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper provides an overview of some of the challenges facing the use of UAV in combat roles. Offensive roles are identified and the suitability of UAV for these discussed. The use of UAV for surveillance, target acquisition and reconnaissance is acknowledged as well established, the roles involving weapon delivery are less defined. The limitations on using UAV in combat roles are not seen dominantly as technical but more operational. The need to define the concept of operations for using UAV in combat is considered vital. Simulation is advocated to establish the viability of combat UAV concepts, conduct performance trade-off studies and to develop appropriate partitioning of control and decision making. Manned and un-manned platforms are seen as being complementary for the foreseeable future with UAV freeing up the manned platforms enabling them to undertake the

roles needing flexibility. The major challenge is seen as establishing an environment in which both manned and un-manned platforms can work together effectively and safely.
Author
*Pilotless Aircraft; Combat; Target Acquisition; Surveillance; Aerial Reconnaissance; Weapon Systems*

19990007862 Defence Evaluation Research Agency, Weapons Sector, Farnborough, UK
**Unmanned Tactical Air Vehicles: An Electronic Combat Perspective**
Langham, S. J., Defence Evaluation Research Agency, UK; Zanker, P. M., Defence Evaluation Research Agency, UK; Jul. 1998; 10p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This discussion paper, arising from project work at UK DERA, considers UTAVs from an electronic combat perspective. The paper will focus firstly upon their application to Electronic Combat roles, and secondly upon the problems of UTAV self protection by means of Defensive Aids Subsystems (DASS). UTAVs will find a variety of roles in the military operations of the future, both in conflict, and in operations other than war, such as peace-keeping and humanitarian aid. This paper identifies in general the various roles and scenarios which may become applicable to UTAVs. Current UTAVs are predominantly used for reconnaissance, however their near-term role is expanding to encompass communications relay, electronic warfare, environmental monitoring, target designation and the suppression of enemy air defences (SEAD) applications. The paper addresses the SEAD scenario, sensor payloads, airframe performance requirements and levels of threat faced. The SEAD role presents a particularly high risk for airframe survivability, as the UTAV is challenging the very threats which may be used against it. Such UTAVs are likely to carry advanced payloads, making for a high-value vehicle, requiring some measure of self-protection. Defensive aids will therefore feature in UTAV system designs. It is important to match the style of defensive aids to the roles and concepts of operation of the various types of vehicle envisaged. The style of self protection may be biased towards threat avoidance, confusion of air defences, or towards the countering of immediate threats. The paper discusses these styles of defensive aids systems, their cost and system drivers, and the types of components needed to realize them. The defensive aids suites could in most cases have to operate without manual intervention, and in this respect will be rather different to the traditional systems found in manned aircraft. The paper discusses these differences, and their implications in terms of system cost, complexity and effectiveness. The style of any countermeasure responses proposed for UTAVs may vary considerably according to the type of operation and the rules of engagement. Consideration must be given to the dangers of collateral damage, and even environmental damage, in certain circumstances. The paper discusses these considerations.
Author
*Electronic Warfare; Air Defense; Pilotless Aircraft; Combat; Airframes*

## 17
## SOCIAL SCIENCES

*Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.*

19990008074 Advisory Group for Aerospace Research and Development, Flight Vehicle Integration Panel, Neuilly-Sur-Seine, France
**Strategic Management of the Cost Problem of Future Weapon Systems** ***Gestion Strategique des Couts des Futurs Systemes d'Armes***
Sep. 1998; 268p; In English; In French; Flight Vehicle Integration Panel Symposium, 22-25 Sep 1997, Drammen, Norway; Sponsored by Advisory Group for Aerospace Research and Development, France; Also announced as 19990008075 through 19990008097; Original contains color illustrations
Report No.(s): AGARD-CP-602; ISBN 92-836-0058-4; Copyright Waived; Avail: CASI; A12, Hardcopy; A03, Microfiche

The Symposium comprised five sessions, each devoted to a particular field: Lessons learned, Overview of current programs, Cost management tools, Low cost manufacturing, and Government perspectives. The Symposium was organized by the Flight Vehicle Integration Panel (FVP) of AGARD and held in Drammen, Norway 22-25 September 1997.
Author
*Weapon Systems; Design to Cost; Cost Analysis; Cost Effectiveness; Cost Reduction; Weapons Development; Management Systems; Aircraft Production; Government/Industry Relations; Aircraft Production Costs; Project Management; Defense Industry*

19990008076 National Defence Headquarters, Project Management Office, Ottawa, Ontario Canada
**'COTS': Customization, Opportunities and Trade-Offs**
Delaney, R. Grant, National Defence Headquarters, Canada; Sep. 1998; 12p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The aim of this paper is to describe the methods by which the Canadian Armed Forces (CF) balanced a commercial off-the-shelf (COTS) process by customization, opportunities and trade-offs (also COTS) as an example towards meeting the cost challenges of the 21st century. This paper will present a description of the specific customization efforts and associated trade-offs as they apply to the CH146 acquisition and fielding. It will not focus on cost benefit opportunities per se as these issues have been discussed in a previous paper. Some repetition of information will be unavoidable in illustrating opportunities achieved in the CH146 helicopter acquisition and introduction into service. Nor is it intended to discuss the decision making process resulting in the opportunity to acquire a common fleet of helicopters to replace three to four types of aircraft. The comparative arguments should allow the reader to make his or her own conclusion in respect of the ability of this aircraft to meet challenges of the future in your own individual programs.
Derived from text
*Helicopters; Cost Effectiveness; Commercialization; Helicopter Design; Systems Integration; Tradeoffs*

19990008079 Boeing Commercial Airplane Co., Systems, Seattle, WA USA
**The Boeing 777: A Look Back**
Glende, Wolf L., Boeing Commercial Airplane Co., USA; Sep. 1998; 12p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Boeing 777 is the largest twin-engine commercial jet transport in service today. In 1990, approval to proceed with its development was contingent on defining an airplane the airlines would buy at a price Boeing could afford. Innovative processes were developed and implemented that focused on achieving customer preference and reduced program cost. These processes centered on Design Build Teams, Digital Product Definition, and Digital Preassembly. Two years after delivery of the first airplane, the data show that the processes made the 777 the preferred airplane, lowered program costs as predicted, and set new standards and expectations for the development of jet transport aircraft.
Author
*Commercial Aircraft; Aircraft Production Costs; Computer Aided Design; Boeing 777 Aircraft; Cost Reduction; Project Management*

19990008081 Thomson-CSF, Radars et Contremesures, Elancourt, France
**Thomson-CSF Experience in Airborne System Integration**
Monclar, Patrick, Thomson-CSF, France; Sep. 1998; 18p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The strategic management of the cost issue is of major importance for any company; basically, the question is to combine the customers' satisfaction and the company's profitability. The customers' satisfaction is met with agreeable and affordable levels of price and performance of the products and systems they buy. The company's profitability is needed to meet the basic rules of capital and strategic investment. In our so called "high tech" companies we have also to take account of the huge level of R and D required to run our projects and programs. More and more, this R and D is partially, if not totally, self-funded by the company itself. Furthermore, cost management must enable us to get the resources which are needed to be in the position to study, then develop and produce the future systems which will be in the Forces, our customers. Many answers can be given to this difficult question of cost management. After having introduced my company, THOMSON-CSF/Radars et Contremesures (RCM), and our main airborne systems, I will address our global methodology dedicated to these systems' studies and developments. This methodology, without any doubt, is the fundamental core of our know-how, not only relying on more or less heavy and sophisticated tools, but also and above all fed by the unique skill of our staff, for decades. Charts outlining RCM and its products and systems overview are presented.
Author
*Cost Effectiveness; Cost Reduction; Systems Integration; Research and Development; Systems Engineering; Aircraft Production Costs; Aircraft Design*

19990008090 British Aerospace Public Ltd. Co., Preston, UK
**The Future for Combat Aircraft Design: An Industrial View**
Skorczewski, L., British Aerospace Public Ltd. Co., UK; Sep. 1998; 4p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The paper addresses the design and technology drivers which are likely to have the most impact on the next generation of combat aircraft from an industrial perspective. The nature of future conflicts and the emerging threats are becoming increasingly difficult to predict, and operational needs stress the growing importance of flexibility and survivability to meet these indefinable future scenarios. The inescapable fact is that market forces are no longer able to support "performance at any cost" because defense budgets worldwide are being reduced and there is increasing competition for fewer orders. The key attribute of any future combat aircraft is now AFFORDABILITY, and the technology and design drivers which find their way into new combat aircraft will be those which provide major life cycle cost savings, whilst meeting adequate performance margins. The processes and mechanisms associated with achievement of major cost savings are discussed as a means of industrial survival in an increasingly competitive and uncertain world.
Author
*Aircraft Design; Aircraft Production Costs; Cost Reduction*

19990008223 General Accounting Office, Office of Public Affairs, Washington, DC USA
**Month in Review: August 1998. Reports, Testimony, Correspondence, and Other Publications**
Aug. 1998; 36p; In English
Report No.(s): PB99-103178; GAO/OPA-98-11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This document contains a list of reports, testimony, correspondence, and other publications on Medicare, Aircraft carriers, and defense spending. It also includes agriculture and food, economic development, energy; financial institutions; financial management, government operations, health, income security, information management, justice and law enforcement, national defense, natural resources, social services, tax policy and administration, transportation, veterans affairs, and special publications.
NTIS
*Aircraft Carriers; Defense Program; Agriculture; Economic Development; Financial Management; Health; Information Management; Law (Jurisprudence); Security; Economic Analysis*

## 18
## SPACE SCIENCES

*Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radation.*

19990005111 George Washington Univ., Joint Inst for Advanced of Flight Sciences, Hampton, VA USA
**Operational Data Reduction Procedure for Determining Density and Vertical Structure of the Martian Upper Atmosphere from Mars Global Surveyor Accelerometer Measurements**
Cancro, George J., George Washington Univ., USA; Tolson, Robert H., George Washington Univ., USA; Keating, Gerald M., George Washington Univ., USA; Oct. 1998; 104p; In English
Contract(s)/Grant(s): NCC1-104; RTOP 865-10-03-01
Report No.(s): NASA/CR-1998-208721; NAS 1.26:208721; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The success of aerobraking by the Mars Global Surveyor (MGS) spacecraft was partly due to the analysis of MGS accelerometer data. Accelerometer data was used to determine the effect of the atmosphere on each orbit, to characterize the nature of the atmosphere, and to predict the atmosphere for future orbits. To interpret the accelerometer data, a data reduction procedure was developed to produce density estimations utilizing inputs from the spacecraft, the Navigation Team, and pre-mission aerothermodynamic studies. This data reduction procedure was based on the calculation of aerodynamic forces from the accelerometer data by considering acceleration due to gravity gradient, solar pressure, angular motion of the MGS, instrument bias, thruster activity, and a vibration component due to the motion of the damaged solar array. Methods were developed to calculate all of the acceleration components including a 4 degree of freedom dynamics model used to gain a greater understanding of the damaged solar array. The total error inherent to the data reduction procedure was calculated as a function of altitude and density considering contributions from ephemeris errors, errors in force coefficient, and instrument errors due to bias and digitization. Comparing the results from this procedure to the data of other MGS Teams has demonstrated that this procedure can quickly and accurately describe the density and vertical structure of the Martian upper atmosphere.
Author
*Upper Atmosphere; Mars (Planet); Mars Atmosphere; Vertical Distribution; Aerodynamic Forces; Data Reduction*

# Subject Term Index

## F



## G



## H



## I



## J



## L



## M



## N



## O



## P

## R



## S



## T



## U



## V



## W

# Personal Author Index

## S



## T



## V



## W



## X



## Y



## Z

# REPORT DOCUMENTATION PAGE

*Form Approved*
*OMB No. 0704-0188*



| 1. AGENCY USE ONLY (*Leave blank*) | 2. REPORT DATE | 3. REPORT TYPE AND DATES COVERED |
|---|---|---|
| | January 8, 1999 | Special Publication |

**4. TITLE AND SUBTITLE**
Aeronautical Engineering
A Continuing Bibliography (Supplement 391)

**5. FUNDING NUMBERS**

**6. AUTHOR(S)**

**7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**
NASA Scientific and Technical Information Program Office

**8. PERFORMING ORGANIZATION REPORT NUMBER**
NASA/SP-1999-7037/Suppl391

**9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)**
National Aeronautics and Space Administration
Langley Research Center
Hampton, VA 23681

**10. SPONSORING/MONITORING AGENCY REPORT NUMBER**

**11. SUPPLEMENTARY NOTES**

**12a. DISTRIBUTION/AVAILABILITY STATEMENT**
Subject Category: Distribution:
Availability: NASA CASI (301) 621-0390

**12b. DISTRIBUTION CODE**
Unclassified--Unlimited
Subject Category - 01

**13. ABSTRACT** *(Maximum 200 words)*
This report lists reports, articles and other documents recently announced in the NASA STI Database.

**14. SUBJECT TERMS**
Aeronautical Engineering
Aeronautics
Bibliographies

**15. NUMBER OF PAGES**
52

**16. PRICE CODE**
A04/HC

| 17. SECURITY CLASSIFICATION OF REPORT | 18. SECURITY CLASSIFICATION OF THIS PAGE | 19. SECURITY CLASSIFICATION OF ABSTRACT | 20. LIMITATION OF ABSTRACT |
|---|---|---|---|
| Unclassified | Unclassified | | |